TAB 1
(part 3)

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
1.	Unloading of components			
1.1	Bottom tower section & ladder (Ref.: Dwg. No. N30-10H-0965)			
1.1.1	Visual inspection of the bottom tower external surface	No damage/	Accepted / Rejected	
1.1.2	Visual inspection of the bottom tower internal surface and structures	No damage	Accepted / Rejected	
1.1.3	Confirmation of the match mark (Ref.: Dwg. No. C2400-FN80M4S-1054)	Recognizable and on the specified location	Accepted / Rejected	
	Comment:			
1.2	Lower middle tower section & ladder (Ref.: Dwg. No. N30-10H-0965)			
1.2.1	Visual inspection of the lower middle tower external surface	No damage	Accepted / Rejected	
1.2.2	Visual inspection of the lower middle tower internal surface and structures	No damage	Accepted / Rejected	
1.2.3	Confirmation of the match mark (Ref.: Dwg. No. C2400-FN80M4S-1054)	Recognizable and on the specified location	Accepted / Rejected	
	Comment:			
1.3	Upper middle tower section & ladder (Ref.: Dwg. No. N30-10H-0965)			
1.3.1	Visual inspection of the upper middle tower external surface	No damage	Accepted / Rejected	
1.3.2	Visual inspection of the upper middle tower internal surface and structures	No damage	Accepted / Rejected	
1.3.3	Confirmation of the match mark (Ref.: Dwg. No. C2400-FN80M4S-1054)	Recognizable and on the specified location	Accepted / Rejected	
	Comment:			
1.4	Top tower section & ladder (Ref.: Dwg. No. N30-10H-0965)			
1.4.1	Visual inspection of the top tower external surface	No damage	Accepted / Rejected	
1.4.2	Visual inspection of the top tower internal surface and structures	No damage	Accepted / Rejected	
1.4.3	Confirmation of the match mark (Ref.: Dwg. No. C2400-FN80M4S-1054)	Recognizable and on the specified location	Accepted / Rejected	
	Comment:			
1.5	Blades (3 pcs) (Ref.: Dwg. No. N30-10H-0965)			
1.5.1	Visual inspection of all the surfaces and components of the blade	No damage	Accepted / Rejected	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
1.5.2	Confirmation of the match mark for the rotor head	Recognizable and on the specified location	Accepted / Rejected	
	Comment:			
1.6	Nacelle yaw module (Ref.: Dwg. No. N30-10H-0965)			
1.6.1	Visual inspection of the yaw module exterior	No damage	Accepted / Rejected	
1.6.2	Inspection of the yaw module interior •Hydraulic unit •Yaw drives •Oil piping •Cleanliness of inside (oil leak, dust, etc.,)	No damage and visually clean	Accepted / Rejected	
1.6.3	Visual inspection of the yaw module bottom part	No damage	Accepted / Rejected	
	Comment:			
1.7	Nacelle front module (Ref.: Dwg. No. N30-10H-0965)			
1.7.1	Visual inspection of the front module exterior	No damage	Accepted / Rejected	
1.7.2	Inspection of the front module interior •Main bearing area •Main shaft and gearbox •Oil coolers and piping •Cleanliness of the inside (oil leak, dust, etc.,)	No damage and visually clean	Accepted / Rejected	
1.7.3	Visual inspection of the front module bottom part	No damage	Accepted / Rejected	
	Comment:			
1.8	Nacelle rear module (Ref.: Dwg. No. N30-10H-0965)			
1.8.1	Visual inspection of the rear module exterior	No damage	Accepted / Rejected	
1.8.2	Inspection of the rear module interior •Generator •Control panel/ cabinets •Cooling system piping •Cleanliness of inside (coolant leak, dust, etc.)	No damage and visually clean	Accepted / Rejected	
1.8.3	Visual inspection of the rear module bottom part	No damage	Accepted / Rejected	
	Comment:			

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
1.9	Rotor head and capsule (Ref.: Dwg. No. N30-10H-0965)			
1.9.1	Visual inspection of the rotor head exterior and capsule	No damage	Accepted / Rejected	
1.9.2	Inspection of the rotor head interior •Hydraulic cylinders and controllers •Oil piping •Cleanliness of inside (oil leak, dust, etc.,)	No damage and visually clean	Accepted / Rejected	
1.9.3	Visual inspection of the rotor head bottom part	No damage	Accepted / Rejected	
	Comment:			
1.10	Nose cone of the rotor head capsule (Ref.: Dwg. No. N30-10H-0965)			
1.10.1	Visual inspection of the nose cone exterior	No damage	Accepted / Rejected	
1.10.2	Visual inspection of the nose cone interior	No damage	Accepted / Rejected	
	Comment:			
1.11	Front module top cover and oil cooler exhaust duct assembly (Ref.: Dwg. No. N30-10H-0965)			
1.11.1	Visual inspection of the top cover exterior	No damage	Accepted / Rejected	
1.11.2	Visual inspection of the top cover interior and the oil cooler exhaust duct	No damage	Accepted / Rejected	
	Comment:			
1.12	UPS panel (Ref.: Dwg. No. N30-10H-0965)			
1.12.1	Visual inspection of the UPS package (crate)	No damage	Accepted / Rejected	
1.12.2	Visual inspection of the UPS exterior (after opening the crate)	No damage	Accepted / Rejected	
	Comment:			
1.13	Bottom tower ground cabinet (Ref.: Dwg. No. N30-10H-0965)			
1.13.1	Visual inspection of the ground cabinet package (crate)	No damage	Accepted / Rejected	
1.13.2	Visual inspection of the ground cabinet exterior (after opening the crate)	No damage	Accepted / Rejected	
1.13.3	Visual inspection of the ground cabinet interior and the electrical components inside	No damage	Accepted / Rejected	
	Comment:			

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
1.14	WTG tools, parts and components (Ref.: Dwg. No. N30-10H-0965)			
1.14.1	Yaw module lifting tool and parts	No damage/ Complete (see the packing list)	Accepted / Rejected	
1.14.2	Front module lifting tool and parts	No damage/ Complete (see the packing list)	Accepted / Rejected	
1.14.3	Rear module lifting tool and parts	No damage/ Complete (see the packing list)	Accepted / Rejected	
1.14.4	Rotor head lifting tool and parts	No damage/ Complete (see the packing list)	Accepted / Rejected	
1.14.5	Electrical cables (in spool)	No damage/ Complete (see the packing list)	Accepted / Rejected	
1.14.6	Electrical accessories shipped as loose kit (in wire mesh)	No damage/ Complete (see the packing list)	Accepted / Rejected	
	Comment:			
2.	Preparation of the foundation (scope of the Customer)			
2.1	Visual inspection of all electrical cables in the foundation	Through the embedded conduit, enough length, and no damage	Accepted / Rejected	
2.2	Resistance of the foundation earth cables	max = 2 ohm	Accepted / Rejected	Record: ____ ohm
2.3	Visual inspection of the foundation	No cracks and visible voids on the surface	Accepted / Rejected	
2.4	Visual inspection of the anchor bolts	Complete, no bend and not rusty	Accepted / Rejected	
2.5	Elevation of the anchor bolt ends.	Refer to the foundation Dwg. of the Customer + mm	Spec. complied / Not	
2.6	Match mark of the tower door on the foundation.	135deg. clockwise of the dominant wind	Spec. complied / Not	
2.7	Difference of the top of the leveling nuts relative to the group of leveling nuts at the opposite (180deg.) of the dominant wind direction.	0 to (-)2mm (max)	Spec. complied / Not	
2.8	Verification mark after setting the leveling nut *This is to check the leveling nut if not accidentally moved*	Pen or spray paint marking	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
2.9	Cleanliness of the foundation	Free of dirt and other debris	Accepted / Rejected	
	Comment:			
3.	Preparation and installation of the bottom tower section			
3.1	Cleaning of the bottom tower section			
3.1.1	Bottom tower section exterior	Free of rust, dirt & stain/ pressure washed	Complied / Not	
3.1.2	Bottom tower section interior	Free of rust, dirt & stain/ pressure washed or mopped	Complied / Not	
3.1.3	Bottom tower section flanges (upper & lower)	free of dirt, rust and high spots	Complied / Not	
3.1.4	Bottom tower section paint (exterior, interior and flanges)	No damage/ remedial painting (if necessary)	Complied / Not	
	Comment:			
3.2	Pre-installation requirements for the bottom tower			
3.2.1	Cable hangers (Ref.: Dwg. 66800-4071) • GL+1700 • GL+4200 • GL+6700	Pre-installed while the bottom tower is laid on the ground	Complied / Not	
3.2.2	Safety cable for the personnel	Pre-installed while the bottom tower is laid on the ground	Complied / Not	
3.2.3	Temporary electrical cords for the lights and power tools	Pre-installed while the bottom tower is laid on the ground	Complied / Not	
3.2.4	Leveling tools, head deflector plate, connecting bolts and spanners necessary for the lower middle tower connection.	Staged onto the platform while the tower is laid on the ground	Complied / Not	
	Comment:			
3.3	Installation of the bottom tower section			
3.3.1	Lifting tools, riggings and accessories.	No damage/ properly checked before use.	Complied / Not	
3.3.2	Tower door	Securely fastened before lifting	Complied / Not	
3.3.3	Final visual inspection before rotating the tower to the upright position	No dirt, stain and paint damage to the tower exteriors	Complied / Not	
3.3.4	Installing the tower onto the leveling nuts	Precautionary measures is used to prevent sudden drop to the leveling nuts	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
3.3.5	Difference in the level of the top flange of the bottom tower X: dominant wind direction Y: perpendicular to the dominant wind direction.	within d/1000 mm against the horizontal d: diameter of the top flange of the bottom tower	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	Actual record, X:____mm Y:____mm
3.3.6	Earth/ ground cable for the bottom tower	No rust on the terminal lug/ terminate soon after the tower level is finalized	Complied / Not	
3.3.7	Foot of the tower ladder	Fixed after the tower level is finalized	Complied / Not	
3.3.8	Non-shrink grout between the tower and foundation *Record the results as per ASTM 939*	Completely filled, properly cured, no cracks and visible voids	Grout Spec.complied / Not	Record, Type:_____ Curing period:_____
3.3.9	Anchor bolt initial tightening/tensioning in accordance to the Customer's foundation design	As specified by the Customer's foundation designer.	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	Record, Tool ID:#_____ Tension:____kN or Torque:____kN-m
3.3.10	Anchor bolt final tension in accordance to the Customer's foundation design	As specified by the Customer's foundation designer	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	Record, Tool ID:#_____ Tension:____kN
3.3.11	Access step in front of the tower door (Ref.: Dwg. 71261-0138)	Installed correctly	Complied / Not	
3.3.12	Touch up paint for the anchor bolts, nuts and tower flange	Painted	Complied / Not	
3.3.13	Anchor bolt cover	Installed after the final tensioning and after the touch-up paint is applied	Complied / Not	
	Comment:			
4.	Installation of the bottom tower ground cabinet and switchgear			
4.1	Installation of the ground cabinet			
4.1.1	Lifting eyebolt of the ground cabinet	Check if securely fastened	Complied / Not	
4.1.2	Wire rope for the lifting of the cabinet	Enough length, traction angle 60deg. maximum	Complied / Not	
4.1.3	Ground cabinet cover (panel doors)	Locked/ securely fastened before lifting	Complied / Not	
4.1.4	Ground cabinet position/ orientation (Ref.: Dwg. 66800-4071)	In accordance w/ the ref. drawing.	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
4.1.5	Ground cabinet mounting bolts	Fully tightened and w/ red paint line marking	Complied / Not	
4.1.6	Ground cabinet earth cable	Connected/ cable terminals were fully tightened and with red paint mark	Connected / Not	
4.1.7	Earth cable resistance	max = 2 ohm	Accepted / Rejected	Record: ohm
	Comment:			
4.2	Installation of the switchgear			
4.2.1	Method of installation	Similar to the ground cabinet installation or in accordance to the Customer's instructions	Complied / Not	
4.2.2	Switch gear position and mountings	In accordance with the Customer's specific instructions	Complied / Not	
	Comment:			
4.3	After the installation of the ground cabinet and switchgear			
4.3.1	Visual check of the cabinet exterior	No damage/ remedial paint is applied (if the paint is damaged)	Accepted / Rejected	
4.3.2	Visual check of the cabinet interior (electrical components)	No damage	Accepted / Rejected	
4.3.3	Visual check of the switchgear exterior	No damage	Accepted / Rejected	
4.3.4	Serial number of the ground cabinet	Record	Complied / Not	
4.3.5	Temporary tarp cover for the ground cabinet	Completely installed	Complied / Not	
4.3.6	Temporary tarpaulin cover for the switchgear	Completely installed	Complied / Not	
	Comment:			
5.	Preparation and installation of the lower middle tower section			
5.1	Cleaning of the lower middle tower section			
5.1.1	Lower middle tower section exterior	Free of rust, dirt & stain/ pressure washed	Complied / Not	
5.1.2	Lower middle tower section interior	Free of rust, dirt & stain/ pressure washed or mopped	Complied / Not	
5.1.3	Lower middle tower section flanges (both upper & lower)	free of dirt, rust and high spots	Complied / Not	
5.1.4	Lower middle tower section paint (exterior, interior and flanges)	No damage/ remedial painting (if necessary)	Complied / Not	
	Comment:			

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
5.2	Pre-installation requirements for the lower middle tower			
5.2.1	Control cables and cable support (Ref.: Dwg. 66800-4071)	Pre-installed while the tower is laid on the ground	Complied / Not	
5.2.2	Safety cable for the personnel	Pre-installed while the tower is laid on the ground	Complied / Not	
5.2.3	Temporary electrical cords for the lights and power tools	Pre-installed while the tower is laid on the ground	Complied / Not	
5.2.4	Necessary tools for the upper middle tower installation (e.g. head deflector plate, connecting bolts, spanners and etc.,)	Staged onto the platform while the tower is laid on the ground	Complied / Not	
	Comment:			
5.3	Installation of the lower middle tower section			
5.3.1	Lifting tools, riggings and accessories.	No damage/ properly checked before use	Complied / Not	
5.3.2	Final visual inspection before rotating the tower to the upright position	No dirt, stain and paint damage to the tower exterior	Complied / Not	
5.3.3	Silicone sealant for the tower flange connection *(Applied in a single continuous bead in the area between outer diameter of the flange and the bolt hole.)*	Applied correctly and not yet cured when the tower is connected	Complied / Not	
5.3.4	Match mark of the tower flanges	Aligned	Complied / Not	
5.3.5	Ladder connection	Aligned/ not bent	Complied / Not	
5.3.6	Connecting bolts orientation •All bolt heads were on the lower flange and with washer •Beveled part of the washer in contact with the bolt head and nut	Installed correctly	Complied / Not	
5.3.7	Connecting bolts I.D.	Numbered in the clockwise order/ direction	Complied / Not	
5.3.8	Ladder splice plate	Installed and tightened before any personnel is allowed to climb	Complied / Not	
5.3.9	Tower earth cables	Installed immediately after the tower is connected	Complied / Not	
5.3.10	Tower earth cable terminal	No rust/ fully tightened/ red line marking is applied after the touch-up paint	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date: | Checked by | Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required.
Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
5.3.11	Head protector/ deflector plate for the tower connecting flange.	Installed/ aligned to the centerline of the ladder	Complied / Not	
5.3.12	Initial tightening of the connecting bolts with an impact wrench	700Nm, first 8pc in star pattern, remaining bolts in circular pattern	Complied / Not	
5.3.13	Initial tightening line marking	Yellow paint pen	Complied / Not	
5.3.14	Final tension of the bottom tower and the lower middle M42 connecting bolts	Final tension: Max = 760kN	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:#_____ Tension:____kN
5.3.15	Line marking after the tensioning of the bolts and checking	Blue paint pen	Complied / Not	
5.3.16	Touch-up paint for the connecting bolts and flange	The same with the tower interior paint	Complied / Not	
5.3.17	Line marking after the touch-up painting	Red paint pen	Complied / Not	
	Comment:			
6.	Preparation and installation of the upper middle tower section			
6.1	Cleaning of the upper middle tower section			
6.1.1	Upper middle tower section exterior	Free of rust, dirt & stain/ pressure washed	Complied / Not	
6.1.2	Upper middle tower section interior	Free of rust, dirt & stain/ pressure washed or mopped	Complied / Not	
6.1.3	Upper middle tower section flanges (both upper & lower)	free of dirt, rust and high spots	Complied / Not	
6.1.4	Upper middle tower section paint (exterior, interior and flanges)	No damage/ remedial painting (if necessary)	Complied / Not	
	Comment:			
6.2	Pre-installation requirements for the upper middle tower			
6.2.1	Safety cable for the personnel	Pre-installed while the tower is laid on the ground	Complied / Not	
6.2.2	Temporary electrical cords for the lights and power tools	Pre-installed while the tower is laid on the ground	Complied / Not	
6.2.3	Necessary tools for the top tower installation (e.g. head deflector plate, connecting bolts, spanners and etc.,)	Staged onto the platform while the tower is laid on the ground	Complied / Not	
	Comment:			

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
6.3	Installation of the upper middle tower section			
6.3.1	Lifting tools, riggings and accessories	No damage/ properly checked before use	Complied / Not	
6.3.2	Final visual inspection before rotating the tower to the upright position	No dirt, stain and paint damage to the tower exterior	Complied / Not	
6.3.3	Silicone sealant for the tower flange connection *(Applied in a single continuous bead in the area between outer diameter of the flange and bolt hole.)*	Applied correctly and not yet cured when the tower is connected	Complied / Not	
6.3.4	Match mark of the tower flanges	Aligned	Complied / Not	
6.3.5	Ladder connection	Aligned/ not bent	Complied / Not	
6.3.6	Connecting bolts orientation • All bolt heads were on the lower flange and with washer • Beveled part of washer in contact with bolt head and nut	Installed correctly	Complied / Not	
6.3.7	Connecting bolts I.D.	Numbered in the clockwise order	Complied / Not	
6.3.8	Ladder splice plate	Installed and tightened before any personnel is allowed to climb	Complied / Not	
6.3.9	Tower earth cables	Installed immediately after the tower is connected	Complied / Not	
6.3.10	Tower earth cable terminal	No rust/ fully tightened/ red line marking is applied after the touch-up paint	Complied / Not	
6.3.11	Head protector/ deflector plate for the tower connecting flange.	Installed/ aligned to the centerline of the ladder	Complied / Not	
6.3.12	Initial tightening of the connecting bolts with an impact wrench	700Nm, first 8pc in star pattern, remaining bolts in circular pattern	Complied / Not	
6.3.13	Initial tightening line marking	Yellow paint pen	Complied / Not	
6.3.14	Final tension of the lower middle and upper middle tower M36 , connecting bolts	Final tension: Max = 550kN	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:#_____ Tension:____kN
6.3.15	Line marking after the tensioning and checking	Blue paint pen	Complied / Not	
6.3.16	Touch-up paint for the connecting bolts and flange	Same with the tower interior paint	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
6.3.17	Line marking after the touch-up painting	Red paint pen	Complied / Not	
	Comment:			
7.	Preparation and installation of the top tower section			
7.1	Cleaning of the top tower section			
7.1.1	Top tower section exterior	Free of rust, dirt & stain/ pressure washed	Complied / Not	
7.1.2	Top tower section interior	Free of rust, dirt & stain/ pressure washed or mopped	Complied / Not	
7.1.3	Top tower section flanges (both upper & lower)	free of dirt, rust and high spots	Complied / Not	
7.1.4	Top tower section paint (exterior, interior and flanges)	No damage/ remedial painting (if necessary)	Complied / Not	
	Comment:			
7.2	Pre-installation requirements for the top tower			
7.2.1	Cable hangers in the cable drum • GL+60350 (Ref.: Dwg. 66800-4071)	Pre-installed while the tower is laid on the ground	Complied / Not	
7.2.2	Safety cable for the personnel	Pre-installed while the tower is laid on the ground	Complied / Not	
7.2.3	Temporary electrical cords for the lights and power tools	Pre-installed while the tower is laid on the ground	Complied / Not	
7.2.4	Necessary tools for the yaw module installation (e.g. bottom nacelle ladder, cable support, cable pulling tools, connecting bolts, spanners and etc.)	Staged onto the platform while the tower is laid on the ground	Complied / Not	
	Comment:			
7.3	Installation of top the tower section			
7.3.1	Lifting tools, riggings and accessories	No damage/ properly checked before use	Complied / Not	
7.3.2	Final visual inspection before rotating the tower to the upright position	No dirt, stain and paint damage to the tower exteriors	Complied / Not	
7.3.3	Silicone sealant for the tower flange connection *(Applied in a single continuous bead in the area between outer diameter of the flange and bolt hole.)*	Applied correctly and not yet cured when the tower is connected	Complied / Not	
7.3.4	Match mark of the tower flanges	Aligned	Complied / Not	
7.3.5	Ladder connection	Aligned/ not bent	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
7.3.6	Connecting bolts orientation • All the bolt heads were on the lower flange and with washer. • Beveled part of the washer in contact with the bolt head and nut	Installed correctly	Complied / Not	
7.3.7	Connecting bolt I.D.	Numbered in the clockwise order	Complied / Not	
7.3.8	Ladder splice plate	Installed and tightened before any personnel is allowed to climb	Complied / Not	
7.3.9	Tower earth cables	Installed immediately after the tower is connected	Complied / Not	
7.3.10	Tower earth cable terminal	No rust/ fully tightened/ red line marking is applied after the touch-up paint	Complied / Not	
7.3.11	Head protector/ deflector plate for the tower connecting flange	Installed/ aligned to the centerline of ladder	Complied / Not	
7.3.12	Initial tightening of connecting bolts with an impact wrench	700Nm, first 8pcs in star pattern, the remaining bolts in circular pattern	Complied / Not	
7.3.13	Initial tightening line marking	Yellow paint pen	Complied / Not	
7.3.14	Final tension of the upper middle and top tower M36 connecting bolts	Final tension Max = 550kN	Spec. complied / Not BOP contractor to initial sign below for confirmation.	Record, Tool ID:#_____ Tension:_____kN
7.3.15	Line marking after the tensioning and checking	Blue paint pen	Complied / Not	
7.3.16	Touch-up paint for the connecting bolts and flange.	Same with tower interior paint	Complied / Not	
7.3.17	Line marking after touch-up painting	Red paint pen	Complied / Not	
	Comment:			
8.	Preparation and installation of the yaw module			
8.1	Preparation of the yaw module			
8.1.1	Exterior transportation cover *(Except the tarpaulin roof and support frame)*	Completely remove	Complied / Not	
8.1.2	Yaw module exterior surfaces	No dirt, stain and paint coat damage to the exterior	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
8.1.3	Initial oil tank level of the hydraulic control unit (tank level gauge)	0 to (-)5mm of the H-Level line	Complied / Not	
8.1.4	Hydraulic oil purifier used for re-filling	Cleanliness is in accordance with ISO 4406 17/14	Complied / Not	
8.1.5	Initial oil tank level of the main bearing lubrication oil (tank level gauge)	MAX-Level line	Complied / Not	
8.1.6	Lubrication oil purifier used for re-filling	Cleanliness is in accordance with ISO 4406 17/14	Complied / Not	
8.1.7	Initial oil level of yaw gear motors (4 units, sight glass)	Above the centerline	Complied / Not	
8.1.8	Accumulator gas pressure -Main accumulator(ACC-101) -Brake accumulator(ACC-102)	 13 MPa +/-___ 17 MPa +/-___	 Sufficient / Insufficient Sufficient / Insufficient	Re-charge if it is insufficient.
8.1.9	Necessary tools for front the module installation (e.g. connecting bolts, ladder assembly, spanners and etc.)	Staged inside the yaw module while on the ground.	Complied / Not	
	Comment:			
8.2	Installation of the yaw module			
8.2.1	Lifting tools, riggings and accessories.	No damage/ properly checked before use.	Complied / Not	
8.2.2	Final visual inspection before lifting the yaw module from the ground	No dirt, stain, remaining covers, and paint damage to exteriors.	Complied / Not	
8.2.3	Yaw module bottom part • Rust preventive coating in the matting surface for top tower	Cleaned before lifting onto the top tower	Complied / Not	
8.2.4	Guide bars	Installed before lifting onto the top tower	Complied / Not	
8.2.5	Match mark of yaw bearing and tower top flange	Aligned	Complied / Not	
8.2.6	Yaw module connecting bolts (Ref.: Dwg. N30-C10-0777) • No clearance between bolt heads, washers and tower flange when installed. • Chamfered part of washer in contact with bolt head. • Applied with lubricants.	Installed correctly	Complied / Not	
8.2.7	Connecting bolt I.D.	Numbered in the clockwise order	Complied / Not	
8.2.8	Initial tightening of the connecting bolts with an impact wrench	700Nm, first 8pcs in star pattern, remaining bolts in circular pattern	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
8.2.9	Initial tightening line marking	Yellow paint pen	Complied / Not	
8.2.10	Nacelle ladder assembly and cable guide (Ref.: Dwg. N30-C10-0777)	Installed correctly/ bolts were properly tightened and with red pain pen marking	Complied / Not	
8.2.11	Yaw brake oil pan (Ref.: Dwg. N30-C10-0970)	Installed correctly/ bolts were properly tightened and with red paint pen marking	Complied / Not	
8.2.12	Automatic yaw bearing lubrication system (if required)	Installed correctly *(optional item)*	Complied / Not *(optional item)*	*(optional item)*
8.2.13	Final torque of the yaw module connecting bolts	Final tightening torque 3,395N-m to 3,495N-m.	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:#_____ Torque:____kN-m
8.2.14	Line marking after the final torque and checking	Blue paint pen	Complied / Not	
8.2.15	Touch-up paint for the yaw module connecting bolts and tower flange.	Same with the tower interior paint	Complied / Not	
8.2.16	Line marking after the touch-up painting	Red paint pen	Complied / Not	
	Comment:			
9.	Preparation and installation of the front module			
9.1	Preparation of the front module			
9.1.1	Exterior transportation cover *(Except the rear tarpaulin cover)*	Removed completely	Complied / Not	
9.1.2	Front module exterior surfaces	No dirt, stain and paint coat damage to the exterior	Complied / Not	
9.1.3	L.O. Coolers (2 units) (Ref.: Dwg. N30-A10-1302) • Set into upright position • Mounting bolts	Installed correctly/ no damage occurred/ bolts fully tightened and with red paint pen mark	Complied / Not	
9.1.4	Flexible hose connections for L.O. coolers (Ref.: Dwg. N30-A10-1302)	Installed correctly, no contaminants when connected/ fully tightened and with red paint pen mark	Complied / Not	
9.1.5	Initial lubrication oil level of the main gearbox (level gauge)	0 to +10mm (max) of the H-Level line	Complied / Not	
9.1.6	Hydraulic oil purifier used for re-filling	Cleanliness is in accordance with ISO 4406 17/14	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required.
Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
9.1.7	Exhaust duct and the top cover assembly (Ref.: Dwg. N30-C10-1019)	No damage/ installed correctly/ Sealant is applied as specified in the drawing.	Complied / Not	
9.1.8	FAA lights (if necessary)	In accordance with the Customer's specifications	Complied / Not	
9.1.9	Disc brake condition before installation of front module	No contact/ Disc rotates freely	Complied / Not	
9.1.10	High speed shaft locking pin	Installed after the confirmation that the disc rotates freely	Complied / Not	
9.1.11	Match mark (for the rotor head) on the main bearing	Top most position	Complied / Not	
	Comment:			
9.2	Installation of the front module			
9.2.1	Lifting tools, riggings and accessories.	No damage/ properly checked before use.	Complied / Not	
9.2.2	Final visual inspection before lifting the front module from the ground	No dirt, stain, remaining covers, and no paint damage to the exterior	Complied / Not	
9.2.3	Front module bottom part and the rust preventive coating in the matting surface for the yaw module	Cleaned before lifting onto the yaw module	Complied / Not	
9.2.4	Guide bars	Installed before lifting onto the yaw module	Complied / Not	
9.2.5	Match mark of the yaw and front modules	Aligned	Complied / Not	
9.2.6	Front module connecting bolts (Ref.: Dwg. N30-C10-0970) •No clearance between the bolt heads, washers and the yaw module tube flange when installed. •Chamfered part of the washer is in contact with the bolt head. •Applied with lubricant	Installed correctly	Complied / Not	
9.2.7	Connecting bolt I.D.	Numbered in the clockwise order	Complied / Not	
9.2.8	Initial tightening of the connecting bolts	700N-m, first 8pcs in the star pattern, remaining bolts in circular pattern	Complied / Not	
9.2.9	Initial tightening line marking	Yellow paint pen	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
9.2.10	Ladder (yaw to the front module access) (Ref.: Dwg. N30-C10-0970)	Installed correctly/ bolts were properly tightened	Complied / Not	
9.2.11	Final torque of the front module connecting bolts	Final tightening torque 3,395N-m to 3,495N-m.	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:#_____ Torque:____ kN-m
9.2.12	Line marking after the final torque and checking	Blue paint pen	Complied / Not	
9.2.13	Touch-up paint for the front module connecting bolts and the tower flange.	The same with the tower interior paint	Complied / Not	
9.2.14	Line marking after the touch-up painting	Red paint pen	Complied / Not	
	Comment:			
10.	Preparation and installation of the rear module			
10.1	Preparation of the rear module			
10.1.1	Exterior transportation cover	Removed	Complied / Not	
10.1.2	Front module exterior surfaces	No dirt, stain and paint coat damage to the exterior	Complied / Not	
10.1.3	Lightning rod and ultrasonic wind sensor assembly (Ref.: Dwg. N30-A10-1350)	No damage/ installed correctly/ Sealant is applied as specified in the drawing	Complied / Not	
10.1.4	Tools, parts and components for the rotor head and nacelle connection (e.g. M36x595 stud bolts, M36nuts, washers, and all necessary tools)	Staged inside the rear module while on the ground	Complied / Not	
10.1.5	Tools, parts and components for the low speed azimuth sensor assembly (Ref.: Dwg. N30-A10-1373)	Staged inside the rear module while on the ground	Complied / Not	
10.1.6	Tools, parts and components for the nacelle cover connection (Ref.: Dwg. N30-C10-1018)	Staged inside the rear module while on the ground	Complied / Not	
10.2	Installation of rear module			
10.2.1	Lifting tools, rigging and accessories.	No damage/ properly checked before use	Complied / Not	
10.2.2	Final visual inspection before lifting the rear module from the ground	No dirt, stain, remaining covers, and no paint damage to the exterior	Complied / Not	
10.2.3	Lifting lug plates for the front module (lug plates on the connecting flange of the nacelle frame)	Removed before lifting the rear module	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required.
Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
10.2.4	Nacelle frame connecting flange (on the front module side)	Cleaned/ no rust/ anti-rust coat is removed before lifting the rear module	Complied / Not	
10.2.5	Nacelle frame connecting flange (on the rear module side)	Cleaned/ no rust/ anti-rust coat is removed before lifting the rear module	Complied / Not	
10.2.6	Guide bars	Installed before lifting the front module	Complied / Not	
10.2.7	Rear module lower frame connecting bolts (Ref.: Dwg. N30-10T-0524) • No clearance between the bolt heads, washers and the flange of the yaw module tube when installed. • Chamfered part of the washer in contact with the bolt head • Applied with lubricant	Installed correctly	Complied / Not	
10.2.8	Rear module upper frame connecting beam and plate ass'y (Ref.: Dwg. N30-10T-0524) • All the bolts were installed • Chamfered part of the washers in contact with the bolt heads	Installed correctly	Complied / Not	
10.2.9	Initial tightening of the lower frame connecting bolts with an impact wrench	700N-m, all bolts tightened in star pattern	Complied / Not	
10.2.10	Initial tightening line marking	Yellow paint pen	Complied / Not	
10.2.11	Final torque of the front module connecting bolts	Final tightening torque 4,420N-m to 4520N-m	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:# Torque: kN-m
10.2.12	Line marking after the final torque and checking	Blue paint pen	Complied / Not	
10.2.13	Touch-up paint for the rear module lower frame connecting bolts and connecting flange	Applied	Complied / Not	
10.2.14	Line marking for the lower frame connecting bolts after the touch-up painting	Red paint pen	Complied / Not	
10.2.15	Torque of the upper frame connecting bolts	575-595N-m	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:# Torque: kN-m
10.2.16	Line marking for the upper frame connecting bolts after the torque	Red paint pen	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
10.2.17	Nacelle cover joining part between the yaw and rear module (Ref.: Dwg. N30-C10-1018)	Installed correctly/ bolts were fully tightened and marked with red paint pen	Complied / Not	
10.2.18	Nacelle cover joining part between the front and rear module (Ref.: Dwg. N30-C10-1018)	Installed correctly/ bolts were fully tightened and marked with red paint pen	Complied / Not	
	Comment:			
11.	Activities after the nacelle installation			
11.1	Installation of the electrical cables, instruments and accessories for the WTG			
11.1.1	Cable routing and the electrical accessories installation inside the tower (Ref.: Dwg. 66800-4521)	Installed correctly as specified in the reference drawing	Complied / Not	
11.1.2	Electrical instruments for the WTG (Ref.: Dwg. 66800-4071)	Installed correctly as specified in the reference drawing	Complied / Not	
	Comment:			
11.2	Activities inside the nacelle			
11.2.1	Nacelle top cover hatches for the personnel and riggings	Properly closed	Complied / Not	
11.2.2	Ladder assembly (yaw to the rear module access) (Ref.: Dwg. N30-C10-0970)	Installed correctly/ bolts were fully tightened and marked with red paint pen	Complied / Not	
11.2.3	Nacelle service winch (Ref.: Dwg. N30-C10-1018)	Installed correctly/ bolts were fully tightened and marked with red paint pen	Complied / Not	
11.2.4	Cables of the lightning rod and ultrasonic wind sensor (Ref.: Dwg. 66800-4071)	Connected properly as specified in the reference drawing	Complied / Not	
11.2.5	Cables of the FAA light (if applicable)	In accordance with the Customer's documentation	Complied / Not	
11.2.6	Cables of the nacelle service winch (Ref.: Dwg. 66800-4071)	Connected properly as specified in the reference drawing	Complied / Not	
11.2.7	Cable terminal joints between the yaw, front and the rear modules (Ref.: Dwg. 66800-4071)	Connected properly as specified in the reference drawing	Complied / Not	
11.2.8	Ground cables for the nacelle cover (Ref.: Dwg. N30-A10-1351)	Connected properly as specified in the reference drawing	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by:		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required.
Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
11.2.9	L.O. piping assembly (Ref.: Dwg. N30-A10-1369)	Connected properly as specified in the reference drawing	Complied / Not	
11.2.10	G.O. piping assembly (Ref.: Dwg. N30-T10-0202)	Connected properly as specified in the reference drawing	Complied / Not	
11.2.11	G.O. piping system	Air is removed by bleeding/ no leaks	Complied / Not	
11.2.12	Flexible joining part of the generator exhaust duct (Ref.: Dwg. N30-A10-1369)	Installed properly as specified in the reference drawing	Complied / Not	
11.2.13	Shipping/ packaging materials inside the nacelle (transportation support, plastic cover, lug plate, fasteners, etc.,)	Completely removed and properly disposed	Complied / Not	
11.2.14	Working areas and the walkways around the nacelle	No oil spill and tripping hazards	Complied / Not	
11.2.15	Nacelle yaw direction	Facing the dominant wind	Complied / Not	
	Comment:			
12.	Preparation of the rotor head and blades			
12.1	Rotor head preparations			
12.1.1	Location of the rotor head for the blade installation	Blade can be installed without interference	Complied / Not	
12.1.2	Ground/ field condition for the assembly of the rotor head	Flat/ the rotor head transport frame will not sink (provide steel plates as required)	Complied / Not	
12.1.3	Transportation cover	Removed	Complied / Not	
12.1.4	Rotor head exterior surface	No dirt, stain and paint coat damage to the exteriors	Complied / Not	
12.1.5	Rotor head interior surfaces, parts and components	No dirt, no damage and no oil leaks	Complied / Not	
12.1.6	Area around the bolt holes for the blade (inside the rotor head)	No dirt, no rust, anti-rust coating is removed	Complied / Not	
12.1.7	Mating surface for the blade (flange area of the blade bearing)	No dirt, no rust, no high spots	Complied / Not	
12.1.8	Temporary hydraulic unit for changing the pitch angle	Properly checked/ no contaminants	Complied / Not	
	Comment:			
12.2	Blade preparations			
12.2.1	Transportation cover	Removed	Complied / Not	
12.2.2	Blade manufacturing number (Ref.: Blade manufacturer's document)	Belongs to the same set	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
12.2.3	Blade exterior	No dirt, stain and paint coat damage to the exterior	Complied / Not	
12.2.4	Blade root parts and components (T-bolts, root cover, and etc.,)	No damage	Complied / Not	
	Comment:			
13.	Installation of the blades			
13.1	#1 blade			
13.1.1	Rigging requirements and the location to pick-up the blade (Ref.: Dwg. N30-10H-0963)	As specified in the ref. drawing	Complied / Not	
13.1.2	Final check after lifting the blade from the staging area	No dirt, stain and paint coat damage	Complied / Not	
13.1.3	Pitch change procedure (Ref.: Dwg. N30-10H-0970)	As specified in the ref. drawing	Complied / Not	
13.1.4	O-ring between blade and bearing	Installed and with grease	Complied / Not	
13.1.5	Match marks of the blade and bearing	Aligned	Complied / Not	
13.1.6	Hydraulic pitch cylinder of the #1 blade after the T-bolts are inserted	Locked/ Restrictor valve "V-214" is closed (full turn clockwise)	Complied / Not	
13.1.7	Middle portion of the #1 blade after the installation	Supported	Complied / Not	
13.1.8	Initial tightening of the blade bolts with an impact wrench	300N-m, In proper sequence as specified in the erection manual	Complied / Not	
13.1.9	Initial tightening line marking	Yellow paint pen	Complied / Not	
13.1.10	Final tension for the blade bolts	425-434kN, In proper sequence as specified in the erection manual	Spec. complied / Not BOP contractor to initial sign below for the confirmation.	Record, Tool ID:#_____ Tension:____kN
13.1.11	Line marking of the blade bolts, nuts and washers after the final tensioning and checking	Blue paint pen	Complied / Not	
13.1.12	Touch-up paint for the washer of the blade bolts	Applied	Complied / Not	
13.1.13	Line marking of the blade bolts, nuts and washers after the touch up painting	Red paint pen	Complied / Not	
13.1.14	Installation of the earth cable (Ref.: Dwg. N30-R10-0776)	Installed as specified in the reference drawing	Spec. complied / Not	
	Comment:			
13.2	#2 blade			
13.2.1	Rigging requirements and the location to pick-up the blade (Ref.: Dwg. N30-10H-0963)	As specified in the ref. drawing	Complied / Not	
13.2.2	Final check after lifting the blade from the staging area	No dirt, stain and paint coat damage	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
13.2.3	Pitch change procedure (Ref.: Dwg. N30-10H-0970)	As specified in the ref. drawing	Complied / Not	
13.2.4	O-ring between the blade and bearing	Installed and with grease	Complied / Not	
13.2.5	Match marks of the blade and bearing	Aligned	Complied / Not	
13.2.6	Hydraulic pitch cylinder of the #2 blade after the T-bolts are inserted	Locked/ Restrictor valve "V-214" is closed (full turn clockwise)	Complied / Not	
13.2.7	Middle portion of the #2 blade after the installation	Supported	Complied / Not	
13.2.8	Initial tightening of the blade bolts	300N-m, In proper sequence as specified in the erection manual	Complied / Not	
13.2.9	Initial tightening line marking	Yellow paint pen	Complied / Not	
13.2.10	Final tension for the blade bolts	425-434kN, In proper sequence as specified in the erection manual	Spec. complied / Not BOP contractor to initial sign below for confirmation.	Record, Tool ID:#_____ Tension:____ kN
13.2.11	Line marking of the blade bolts, nuts and washers after the final tensioning and checking	Blue paint pen	Complied / Not	
13.2.12	Touch-up paint for the washer of the blade bolts	Applied	Complied / Not	
13.2.13	Line marking of the blade bolts, nuts and washers after the touch up painting	Red paint pen	Complied / Not	
13.2.14	Installation of the earth cable (Ref.: Dwg. N30-R10-0776)	Installed as specified in the reference drawing	Spec. complied / Not	
	Comment:			
13.3	#3 blade			
13.3.1	Rigging requirements and the location to pick-up the blade (Ref.: Dwg. N30-10H-0963)	As specified in the ref. drawing	Complied / Not	
13.3.2	Final check after lifting the blade from the staging area	No dirt, stain and paint coat damage	Complied / Not	
13.3.3	Pitch change procedure (Ref.: Dwg. N30-10H-0970)	As specified in the ref. drawing	Complied / Not	
13.3.4	O-ring between the blade and bearing	Installed and with grease	Complied / Not	
13.3.5	Match marks of the blade and bearing	Aligned	Complied / Not	
13.3.6	Hydraulic pitch cylinder of #3 blade after the T-bolts are inserted	Locked/ Restrictor valve "V-214" is closed (full turn clockwise)	Complied / Not	
13.3.7	Middle portion of the #3 blade after the installation	Supported	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
13.3.8	Initial tightening of the blade bolts	300N-m, In proper sequence as specified in the erection manual	Complied / Not	
13.3.9	Initial tightening line marking	Yellow paint pen	Complied / Not	
13.3.10	Final tension for the blade bolts	425-434kN, In proper sequence as specified in the erection manual	Spec. complied / Not BOP contractor to initial sign below for confirmation.	Record, Tool ID:#_____ Tension:____kN
13.3.11	Line marking of the blade bolts, nuts and washers after the final tensioning and checking	Blue paint pen	Complied / Not	
13.3.12	Touch-up paint for the washer of the blade bolts	Applied	Complied / Not	
13.3.13	Line marking of the blade bolts, nuts and washers after the touch up painting	Red paint pen	Complied / Not	
13.3.14	Installation of the earth cable (Ref.: Dwg. N30-R10-0776)	Installed as specified in the reference drawing	Spec. complied / Not	
	Comment:			
14.	Connecting the rotor head with blades to the nacelle			
14.1	Preparation of the rotor head with blades			
14.1.1	Temporary hydraulic unit for the pitch change	Disconnected after installing all the three blades	Complied / Not	
14.1.2	Blade root checking after the installation of the earth cables (all 3 blades)	Whole area is clean/ no tools and other objects were left inside the blade root	Checked / Not	
14.1.3	Cover for the blade root access manholes	Installed (for all 3 blades)	Complied / Not	
14.1.4	Accumulator gas pressure #1(ACC-211), #2(ACC-221) #3(ACC-231)	8MPa +/- 8MPa +/- 8MPa +/-	Sufficient/ Insufficient Sufficient/ Insufficient Sufficient/ Insufficient	
14.1.5	Oil piping and condition inside of the rotor head	No leaks/ No dirt and other debris	Accepted / Rejected	
14.1.6	Nose cone of the rotor head capsule (Ref.: Dwg. N30-C10-1003)	Properly installed as specified in the reference drawing	Spec.complied / Not	
14.1.7	Final checking of the exterior -Blade, -Rotor head and canopy, -Device installed in rotor head,	No damage No damage No damage	No damage / Found No damage / Found No damage / Found	Report to seller if damage is found.
14.1.8	Temporary stand for the rotor head (Ref.: Dwg. 92100-0521)	Properly assembled as specified in the reference drawing	Complied / Not	
14.1.9	Lifting lug plate for the rotor head and main crane rigging	Properly installed/ crane riggings were checked before use	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
14.1.10	Tail crane rigging on the #1 blade	Properly installed and with the edge protector	Complied / Not	
14.1.11	When the rotor head with blade is onto the temporary stand	Transportation frame of the rotor head is properly fixed onto the stand	Complied / Not	
	Comment:			
14.2	Blade pitch change to the feather position			
14.2.1	Site wind speed	Less than 7m/s	Complied / Not	
14.2.2	Tail crane rigging on the #1 blade	Enough slack or the sling is completely disconnected from the crane hook	Complied / Not	
14.2.3	Supports in the middle portions of the blades (all three)	Completely removed	Complied / Not	
14.2.4	Restrictor valves "V-214" for the pitch hydraulic cylinders (3pcs)	Opened/ fully turned counter-clockwise	Complied / Not	
14.2.5	Temporary hydraulic unit	Properly installed/ connectors are free of contaminants	Complied / Not	
14.2.6	Swing area of the three blades	Free of any obstructions	Complied / Not	
14.2.7	Pitch change	Feather position	Complied / Not	
	Comment:			
14.3	Installation of the rotor head to the nacelle			
14.3.1	Site wind speed	Less than 7m/s	Complied / Not	
14.3.2	Blade pitch angle	Feather position	Complied / Not	
14.3.3	Nacelle drive train (main shaft) final check / confirmation before lifting the rotor head	Rotates freely/ match mark for the rotor head is on the top most position	Complied / Not	
14.3.4	Hydraulic pitch cylinders (all 3 units) condition before lifting the rotor head	Locked/ Restrictor valves "V-214" were closed (full turn clockwise)	Complied / Not	
14.3.5	Tail crane rigging on the #1 blade	Properly installed with edge protector	Complied / Not	
14.3.6	Taglines on the tip of the #2 & #3 blades	Properly connected with blade socks	Complied / Not	
14.3.7	Loose end of the blade taglines	Anchored to a vehicle or a suitable tie off points	Complied / Not	
14.3.8	Final check before lifting the rotor head from the stand	Whole area and surfaces are clean/ no tools and other objects were left inside the rotor head	Complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
14.3.9	Guide bar on the rotor head bolt hole (on bolt hole with match mark)	Installed properly	Complied / Not	
14.3.10	When changing the rotor head from horizontal to the vertical position	#1 blade tip never touched the ground	Complied / Not	
14.3.11	Match marks for the rotor head and main shaft	Aligned	Complied / Not	
14.3.12	Rotor head connecting bolts (stud bolts)	Properly installed and with lubricant	Complied / Not	
14.3.13	Initial tightening of the rotor head stud bolts	300N-m, In proper sequence as specified in the erection manual	Complied / Not	
14.3.14	Initial tightening line marking	Yellow paint pen	Complied / Not	
14.3.15	Gear motor on the high speed shaft (Ref.: Dwg. N30-G10-0418)	Installed immediately after connecting the rotor head	Complied / Not	
14.3.16	Final tension for the rotor head stud bolts	695-700kN, In proper sequence as specified in the erection manual	Spec. complied / Not BOP contractor to initial sign below for confirmation.	Record, Tool ID:#_____ Tension:____kN
14.3.17	Line marking of the rotor head stud bolts, nuts and washers after the final tensioning and checking	Blue paint pen	Complied / Not	
14.3.18	Touch-up paint for the washer of the rotor head stud bolts	Applied	Complied / Not	
14.3.19	Line marking of rotor head stud bolts, nuts and washers after the touch up painting	Red paint pen	Complied / Not	
14.3.20	Rotor head lifting lug cover (hinged fiberglass cover of the rotor head) after the removal of crane rigging	Properly installed/ bolts were fully tightened	Complied / Not	
14.3.21	Rotor head hydraulic piping (Ref.: Dwg. N30-A10-1357)	Properly installed as specified in the reference drawing	Spec. complied / Not	
14.3.22	Restrictor valves "V-214" for the pitch hydraulic cylinders (3pcs) after connecting the hydraulic piping	Opened/ fully turned counter-clockwise	Complied / Not	
14.3.23	Visual check before leaving the inside of rotor head	Whole area is clean/ no tools and other objects were left inside the rotor head	Complied / Not	
14.3.24	Earth/ grounding brush (Ref.: Dwg. N30-R10-0735)	Installed as specified in the reference drawing	Spec. complied / Not	

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
14.3.25	Rotor speed sensor assembly (Ref.: Dwg. N30-A10-1373)	Installed as specified in the reference drawing	Spec. complied / Not	
14.3.26	Main bearing cover assembly (Ref.: Dwg. N30-A10-1373)	Installed as specified in the reference drawing	Spec. complied / Not	
14.3.27	Taglines on the blade tip	Removed by running the turning device (gear motor)	Complied / Not	
	Comment:			
15.	Installation of the high speed shaft coupling			
15.1	Setting the coupling hub alignment of the gearbox and generator			
15.1.1	Alignment of the gearbox and generator coupling (Ref.: Dwg. N30-G10-0422) • #1 blade: @ 0 deg. or at top most position Nacelle: Facing the dominant wind direction *Note:* • Pt. A = @ zero deg. (top most) of generator coupling hub being viewed from the rotor head. • Pt. B = @ 90 deg. to the left of "Pt. A" being viewed from the rotor head. • Pt. C = @ 180 deg. (opposite) of "Pt. A" being viewed from the rotor head. • Pt. D = @ 90 deg. to the right of "Pt. A" being viewed from the rotor head. • Ensure that all measured points are clean and not rusty. • Mark each point with a permanent pen.	■Distance of the flange face at Pt. A when zero reading of dial indicator is set: D = 700±0.5mm ■Allowable run-out of coupling flange face: Pt. A: ±10 Pt. B: ±10 Pt. C: ±10 Pt. D: ±10 ■Required run out (radial eccentricity) of coupling hub: Pt. A: ±10 Pt. B: -50 to -70 Pt. C: -50 to -70 Pt. D: ±10 *Note:* Run-out values are the actual reading of a 0.01mm graduation dial gauge	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	■Measured distance of flange face at Pt. A when zero reading of dial indicator is set: D = _____mm ■Measured run-out of coupling flange face: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____ ■Measured run-out (radial eccentricity) of coupling hub:: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required.
Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
15.1.2	Alignment of the gearbox and generator coupling (Ref.: Dwg. N30-G10-0422) #1 blade: @ 90 deg. or horizontal position Nacelle: Facing the dominant wind direction *Note:* • Pt. A = @ zero deg. (top most) of generator coupling hub being viewed from the rotor head. • Pt. B = @ 90 deg. to the left of "Pt. A" being viewed from the rotor head. • Pt. C = @ 180 deg. (opposite) of "Pt. A" being viewed from the rotor head. • Pt. D = @ 90 deg. to the right of "Pt. A" being viewed from the rotor head. • Ensure that all measured points are clean and not rusty. • Mark each point with a permanent pen.	■Distance of the flange face at Pt. A when zero reading of dial indicator is set: D = 700±0.5mm ■Allowable run-out of coupling flange face: Pt. A: ±10 Pt. B: ±10 Pt. C: ±10 Pt. D: ±10 ■Required run out (radial eccentricity) of coupling hub: Pt. A: ±10 Pt. B: -50 to -70 Pt. C: -50 to -70 Pt. D: ±10 *Note:* Run-out values are the actual reading of a 0.01mm graduation dial gauge	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	■Measured distance of flange face at Pt. A when zero reading of dial indicator is set: D = _____mm ■Measured run-out of coupling flange face: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____ ■Measured run-out (radial eccentricity) of coupling hub:: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____
15.1.3	Alignment of the gearbox and generator coupling (Ref.: Dwg. N30-G10-0422) #1 blade: @ 180 deg. or at the lowest position Nacelle: Facing the dominant wind direction *Note:* • Pt. A = @ zero deg. (top most) of generator coupling hub being viewed from the rotor head. • Pt. B = @ 90 deg. to the left of "Pt. A" being viewed from the rotor head. • Pt. C = @ 180 deg. (opposite) of "Pt. A" being viewed from the rotor head. • Pt. D = @ 90 deg. to the right of "Pt. A" being viewed from the rotor head. • Ensure that all measured points are clean and not rusty. • Mark each point with a permanent pen.	■Distance of the flange face at Pt. A when zero reading of dial indicator is set: D = 700±0.5mm ■Allowable run-out of coupling flange face: Pt. A: ±10 Pt. B: ±10 Pt. C: ±10 Pt. D: ±10 ■Required run out (radial eccentricity) of coupling hub: Pt. A: ±10 Pt. B: -50 to -70 Pt. C: -50 to -70 Pt. D: ±10 *Note:* Run-out values are the actual reading of a 0.01mm graduation dial gauge	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	■Measured distance of flange face at Pt. A when zero reading of dial indicator is set: D = _____mm ■Measured run-out of coupling flange face: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____ ■Measured run-out (radial eccentricity) of coupling hub:: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____

ERECTION WORK RECORD / CHECK SHEET

Date: | Checked by | Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
15.1.4	Alignment of the gearbox and generator coupling (Ref.: Dwg. N30-G10-0422) #1 blade: @ 270 deg. Nacelle: Facing the dominant wind direction *Note:* • Pt. A = @ zero deg. (top most) of generator coupling hub being viewed from the rotor head. • Pt. B = @ 90 deg. to the left of "Pt. A" being viewed from the rotor head. • Pt. C = @ 180 deg. (opposite) of "Pt. A" being viewed from the rotor head. • Pt. D = @ 90 deg. to the right of "Pt. A" being viewed from the rotor head. • Ensure that all measured points are clean and not rusty. • Mark each point with a permanent pen.	■Distance of the flange face at Pt. A when zero reading of dial indicator is set: D = 700±0.5mm ■Allowable run-out of coupling flange face: Pt. A: ±10 Pt. B: ±10 Pt. C: ±10 Pt. D: ±10 ■Required run out (radial eccentricity) of coupling hub: Pt. A: ±10 Pt. B: -50 to -70 Pt. C: -50 to -70 Pt. D: ±10 *Note:* Run-out values are the actual reading of a 0.01mm graduation dial gauge	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	■Measured distance of flange face at Pt. A when zero reading of dial indicator is set: D = _____mm ■Measured run-out of coupling flange face: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____ ■Measured run-out (radial eccentricity) of coupling hub:: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____
15.1.5	Average run-out *Note:* Sum up the measured values for each position of the #1 blade (0, 90, 180, 270 deg.) then divide it by four to get the average.	■Allowable run-out of the coupling flange face: Pt. A: ±10 Pt. B: ±10 Pt. C: ±10 Pt. D: ±10 ■Required run out (radial eccentricity) of the coupling hub: Pt. A: ±10 Pt. B: -50 to -70 Pt. C: -50 to -70 Pt. D: ±10	Spec.complied / Not BOP contractor to initial sign below for confirmation. _____	■Computed run-out of the coupling flange face: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____ ■Computed run-out (radial eccentricity) of the coupling hub:: Pt. A:_____ Pt. B:_____ Pt. C:_____ Pt. D:_____
15.1.6	Installation of the flexible coupling assembly (Ref.: Dwg. N30-G10-0422)	Properly installed as specified in the reference drawing	Spec. complied / Not	
15.1.7	Final torque for the generator mounting bolts	3395-3495N-m, with lubricants, red paint pen mark is applied	Spec. complied / Not BOP contractor to initial sign below for confirmation. _____	Record, Tool ID:#_____ Torque:_____kN-m
15.1.8	Final torque for the flexible coupling mounting bolts	180N-m, with "Loctite 2701", red paint pen mark is applied	Spec. complied / Not BOP contractor to initial sign below for confirmation. _____	Record, Tool ID:#_____ Torque:_____kN-m

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
15.1.9	Installation of the coupling cover assembly (Ref.: Dwg. N30-A10-0325)	Properly installed as specified in the reference drawing/ all the bolts were fully tightened and with red paint pen mark	Spec. complied / Not	
	Comment:			
16.	Miscellaneous activities			
16.1	Final check in the rotor head			
16.1.1	Electrical cables	Properly installed and fixed/ no damaged	Confirmed/ Not	
16.1.2	Hydraulic piping connections	Properly installed no leaks/ no damaged	Confirmed/ Not	
16.1.3	General appearance	Visually clean/ no dirt and oil spill/ no tools left inside	Confirmed/ Not	
16.1.4	Manhole covers	Installed/ bolts were fully tightened	Confirmed/ Not	
	Comment:			
16.2	Around the nacelle			
16.2.1	Electrical cables	Properly installed and fixed/ no damaged	Confirmed/ Not	
16.2.2	Hydraulic piping connections	Properly installed no leaks/ no damaged	Confirmed/ Not	
16.2.3	All connecting and mounting bolts	Fully tightened and with red pain pen mark	Confirmed/ Not	
16.2.4	All access hatch	Closed and properly fixed/ no damage	Confirmed/ Not	
16.2.5	Turning device (gear motor)	Placed into standby position (gear is not engaged) after completing the assembly activities	Complied / Not	
16.2.6	General appearance	Visually clean/ no dirt and oil spill/ no tools left inside	Confirmed/ Not	
16.2.7	Manhole/ access covers	Closed/ bolts were fully tightened	Confirmed/ Not	
	Comment:			

ERECTION WORK RECORD / CHECK SHEET

Date:		Checked by		Page /

Note:
Encircle the applicable item in the "result" column. In-case the specification or requirement is not satisfactorily complied, make a "punch list" and state the item number and the description of action(s) required. Multiple punch lists may be used as required.

Item No.	Check List	Specification/ Requirement	Result	Remarks
16.3	Inside the tower			
16.3.1	Tower lights	Properly installed and fixed/ bolts were fully tightened and with red pain pen mark	Confirmed/ Not	
16.3.2	All electrical cables	Properly installed and fixed/ no damaged	Confirmed/ Not	
16.3.3	All electrical cable connections	Properly connected	Confirmed/ Not	
16.3.4	All tower connecting bolts	Fully tightened and with red pain pen mark	Confirmed/ Not	
16.3.5	All connecting bolts that needs touch-up paint	Properly painted	Confirmed/ Not	
16.3.6	All tower earth/ ground cables	Properly installed/ bolts were fully tightened and with red pain pen mark	Confirmed/ Not	
16.3.7	General appearance inside the tower	Visually clean/ no dirt and oil spill/ no tools left inside	Confirmed/ Not	
	Comment:			

The following persons verify that the record of erection checks has been completed satisfactory, with the exception of the items detailed on the Punch List.

· VERIFYING PERSONS
The following persons have witnessed the erection check and agreed with the result of

WTG No.:_____

_____:
As Project company

_____
Name:

_____:
As Sub-Contractor responsible for Erection, Installation.

_____
Name:

Mitsubishi Power System Americas, Inc.:
As Seller

_____
Name:

EXHIBIT - K

[FORM OF] COMMISSIONING CERTIFICATE

Wind Turbine No: ____ (the "WTG")
Date: _____

1. Capitalized terms used herein have the meaning set forth in the Appendix I ("Definitions") to the Wind Turbine Generators Supply Agreement, dated as of March , 2007 ("Supply Agreement"), by and between Babcock & Brown Infrastructure Group US LLC, as Owner ("Owner"), and Mitsubishi Power Systems Americas, Inc., as Seller (the "Seller").

2. Seller has delivered this certificate, completed except for signature of Owner, to Owner's duly authorized representative on the date first set forth above.

3. Seller certifies and represents, with respect to the WTG referenced above, that the following statements are true as of the date set forth above:

   (a) Commissioning of the WTG has been conducted and has met or exceeded the requirements set forth in the Commissioning Procedures;

   (b) Mechanical Completion of the WTG has occurred;

   (c) The Commissioning Procedures for such WTG have been successfully completed and the Commissioning Check Sheet has been completed and signed by Seller;

   (d) The WTG is ready for initial operation in accordance with the O&M Procedures Manual.

[*Remained of Page Intentionally Blank.*]

The persons signing below are authorized to submit this certificate to Owner for and on behalf of Seller.

Mitsubishi Power Systems Americas, Inc., as Seller

By:_____ Date: _____
Name:_____
Title:_____

Acknowledged and agreed by the undersigned, who hereby certifies that he or she is authorized to countersign this certificate for and on behalf of Owner.

Babcock & Brown Infrastructure Group US, LLC, as Owner

By:_____ Date: _____
Name:_____
Title:_____

Meter read prior to Commissioning of WTG _____
Meter read at time of Commissioning of WTG _____
Date _____ Time _____

Owner's acknowledgement signature of meter reading _____

EXHIBIT – L

[FORM OF] SUBSTANTIAL COMPLETION CERTIFICATE

DATE: _____

1. Capitalized terms used herein have the meanings set forth in Appendix I to the Wind Turbine Generators Supply Agreement, dated March __, 2007 (the "Supply Agreement"), by and between Mitsubishi Power Systems Americas, Inc., as seller ("Seller") and Babcock & Brown Infrastructure Group US LLC, as owner ("Owner").

2. Seller has delivered this certificate, completed except for signature by Owner, to Owner's duly authorized representative on the date first set forth above.

3. Seller certifies and represents that the following statements are true as of the date first set forth above:

   (i) All of the [***insert either***, "Base Turbines and the Transfer" ***or*** "Additional", ***as applicable***] Turbines and all Wind Turbine Work with respect to the [***insert either*** "Base Turbines and the Transfer Turbines" ***or*** "Additional Turbines", ***as applicable***] performed through such date has been performed, except as provided in the Punch List, in accordance with the Requirements, and Seller is not aware of any conditions that would otherwise entitle Owner upon Substantial Completion of the [***insert either*** "Base Turbines and the Transfer Turbines" ***or*** "Additional Turbines", ***as applicable***] to Warranty Repair or Warranty Retrofit under the Warranty Agreement except as set forth on the Punch List;

   (ii) Seller has completed Commissioning with respect to all of the [***insert either*** "Base Turbines and the Transfer" ***or*** "Additional", ***as applicable***] Turbines;

   (iii) The Commissioning Procedures attached to the Supply Agreement as Exhibit M-1 have been met or exceeded;

   (iv) Seller has completed all of the Wind Turbine Work with respect to the [***insert either*** "Base Turbines and the Transfer Turbines" ***or*** "Additional Turbines", ***as applicable***], to be provided under the Supply Agreement, other than any Punch List items;

   (v) Seller has prepared and submitted to Owner the Punch List for the [***insert either*** "Base Turbines and the Transfer Turbines" ***or*** "Additional Turbines", ***as***

applicable];

(vi) Owner has received a conditional waiver and release, in the form specified in Exhibit-U-1, upon progress payment, of all liens, security interests or encumbrances that Seller or any of its subcontractors may have against Owner, the Project and the Site to the extent that payments have been received by Seller under the Supply Agreement;

(vii) Seller and Owner have entered into the Escrow Agreement and Seller has deposited the Escrow Items with Escrow Agent;

(viii) With respect to Substantial Completion of the Base Turbines and the Transfer Turbines, Seller has delivered to Owner a general list of the types and recommended quantities of the Spare Parts;

(ix) A stock of Spare Parts for the [***insert either*** "Base Turbines and the Transfer" ***or*** "Additional", ***as applicable***] Turbines is in storage at the Site or Seller's storage facilities at Mojave, California; and

(x) Seller has issued and delivered to Owner for its countersignature this Substantial Completion Certificate in accordance with the provisions of Section 9.3(e).

4. The person signing below is authorized to submit this certificate to Owner for and on behalf of Seller.

Mitsubishi Power Systems Americas, Inc.

By: _____

Name: _____

Title: _____

Acknowledged and agreed by the undersigned, who hereby certifies that he or she is authorized to countersign this certificate for and on behalf of Owner:

Babcock & Brown Infrastructure Group US LLC

By: _____

Name: _____

Title: _____

Exhibit M

Commissioning Procedures and Check Sheet

PLAN RECORD			
ISO METRIC SCREW THREADS	1	Revised entire documents dated Dec.7th ,2007	

DRAWING NO. N30-10H-0991

第二下

Customer	
一工作DC	1
品保DC	1
計電風車	1
風建	1
土建風車	1
風ﾌﾟﾛ	1
風技ｹ	1
風技開	1
風構設	1
横製風車課	
組立長浜	1
機品一長浜	1
MPSA ロス	1
計	12
出図先	

CONFERRED

MITSUBISHI HEAVY INDUSTRIES, LTD.
CONFIDENTIAL & PROPRIETARY INFORMATION

TECHNICAL INFORMATION AND TRADE SECRETS IN THIS DRAWING OR DOCUMENT IS THE PROPERTY OF MITSUBISHI HEAVY INDUSTRIES, LTD (MHI) AND IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR IN PART, OR USED FOR THE BENEFIT OF ANY ONE OTHER THAN MHI WITHOUT MHI'S PRIOR WRITTEN CONSENT.
THIS DOCUMENT OR DRAWING IS PROTECTED BY COPYRIGHT LAW, UNFAIR COMPETITION LAW, CIVIL LAW AND INTERNATIONAL TREATY PROVISIONS AND ANY APPLICABLE LAWS OF JAPAN AND THE COUNTRY IN WHICH IT IS BEING USED.

WIND POWER SYSTEM BUSINESS UNIT	Standard of MWT95/2.4	
APPROVED		
CHECKED Y.Kawai / K.Imasaki	MWT95/2.4 Commissioning Procedure	
DRAWN T.Tsutsumi		
SCALE N.S		
ORDER 5229M	ITEM	DRAWING NO. N30-10P-0705 / REV.NO. 1

MITSUBISHI HEAVY INDUSTRIES, LTD.
NAGASAKI SHIPYARD & MACHINERY WORKS

DRAWN 6 November 2007 ISSUED

MITSUBISHI HEAVY INDUSTRIES, LTD.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 General

This document describes the commissioning procedure for MWT95/2.4 wind turbine to be performed during WTG construction period.

With regard to the wind turbine installed at the project site, grid coupling test and other safety function tests will be executed.
Basically this procedure is applied to be carried out by the commissioning personnel supported by technical advisor of WTG manufacture. The technical advisor shall evaluate the personnel's skill and capability to manage this task.

1.2 Safety Notice

When stop commissioning work incompletely for lunch or at end of the day, keep wind turbine to the following safety states.

(1) Blade should be at feathering position and shaft in no locked condition.
(If calm wind (Ave.15m/s or less), it is O.K. to apply high speed locking pin).
(2) Yawing to 90 degree toward the dominant wind direction after yaw drive adjusted.

2. MWT92(95)/2.4 SPECIFICATION

(1) Wind Turbine Type

Type	MWT95/2.4
Manufacture	MHI

(2) Performance

Rated Output	Pel = 2400kW
Cut-in Wind Speed	3.0 (m/s)
Rated Wind Speed	12.0 (m/s)
Cut-out Wind Speed	25.0 (m/s) (30m/s : Instantaneous)
Reset of Cut-out	20.0m/s
Design Maximum wind Speed	70.0 (m/s) (Instantaneous)
Control strategy	Full span pitch regulation
Yaw System	Active Control

(3) Rotor

Number of Blade	3
Diameter	95 (m)
Rotational Speed	9.0 – 16.9 (rpm) rated 15rpm
Rotational Direction	Clockwise (as viewed from windward)
Orientation	Upwind
Cone Angle	-2 (deg)
Tilt Angle	5 (deg)

(4) Blade

Length	46.2 (m)
Material	GFRP
Airfoil	NACA 63.4XX
Twist	20.803 (deg)
Chord Length - Tip - Root	 3513 (mm) 1136 (mm)

(5) Gear Box

Type	Planetary & 2- Stage Parallel	
Gear Ratio	~~1 : 76.7 (50Hz)~~	1 : 90.6 (60Hz)
Rating(Output)	2500 kW (~~50~~/60Hz)	
Rotational Speed		
- High Speed Shaft	~~1154rpm at rated speed (50Hz)~~	1359rpm at rated speed (60Hz)
- Low Speed Shaft	15 rpm at rated speed	

(6) Generator

Type	Three phase asynchronous generator with wound rotor	
Rated Capacity	2520kW	
Power Factor	0.9 inductive ~0.95 capacitive	
Number of Poles	6	
Rated Speed	~~1151rpm(50Hz),~~	1359rpm(60Hz)
Slip ratio	~~-11.5%(50Hz),~~	-13.3%(60Hz)
Frequency	50 (Hz)	60(Hz)
Voltage	690 (v)	
Enclosure & Protection	Totally-Enclosed-Air-to-Air-Cooling (IP54)	
Rotor Type	Wound Rotor	
Insulation	H	
Rating	Continuous	

(7) **Brake**

Aerodynamic Brake	Blade Feathering
Service Brake	Disk Brake (High Speed Shaft)

(8) **Tower**

Type	Taper Mono-pole

Hub Height	70m	80m	80m
Top Diameter (excluding tower top flange)	3m	3m	3m
Base Diameter (excluding tower bottom flange)	4m	4.8m	4.24m

3. Checks before commissioning

3.1 Pre-commissioning

The commissioning work shall be done according to this procedure.
Generally, the commissioning work is executed connected to grid network.
If the grid network connection is postponed, the commissioning cannot proceed as on this document by lack of electricity.
In that case, use the DG(Diesel Generator) to continue the commissioning.

3.2 Mechanical completion certificate

Commissioning can not be started before checking mechanical completion certificate which verifies the completion of all construction work.

4. Drawing

4.1 Control Oil System

Piping & Instrument Diagram: N30-10P-0635
(Power Pack Drawing: "HAWE" A6048S20)

4.2 Lubricating Oil System

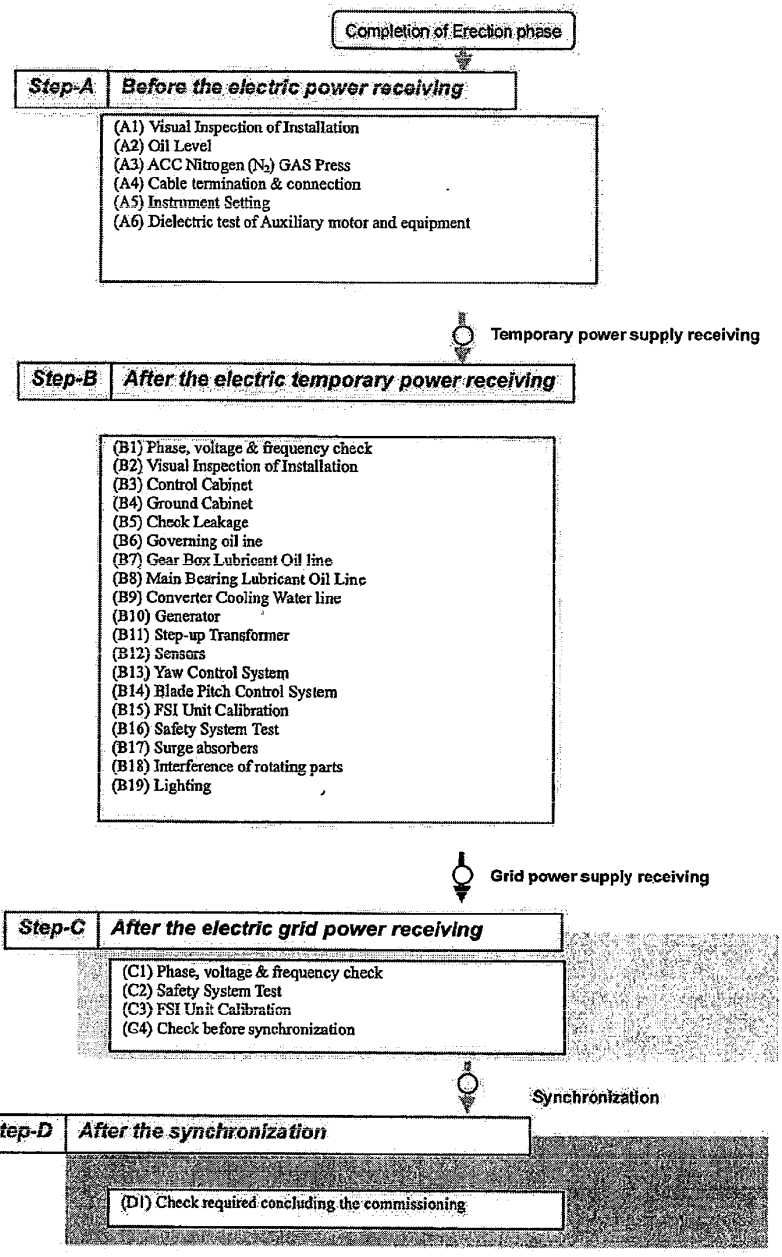
Piping Instrument Diagram: N30-10P-0625

4.3 Single Line Diagram

Single Line Diagram : 66800-7011

5. Working Steps of Commissioning

The commissioning process is shown from next page according to the outline steps shown below.



No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
Step A. Before Electric Power Receiving:						
A1	Visual Inspection of Installation	(1) Check the tightening of structural bolts	Visual check the tightening of structural bolts and review the erection record. (a) Blade connecting bolts (b) Hub connecting bolts (c) Tower-Yaw module connecting bolts (d) Tower middle flange bolts (e) Tower internal ladder installation (f) Bolts for tower and Ground Cabinet	No looseness bolt connection. -High speed coupling bolts -Rear frame bolts -Yaw connecting upper bolts	Bolt tightening will be already checked before nacelle installation. Accordingly visual checking only for commissioning.	In case of working on the air, wear safety belt. There is a possibility of death or fatal injurery.
		(2) Visual inspection of damage	Inspect fatal damages or failures on the following main components by visual check: (a) Blades (b) HUB (c) Nacelle (Yaw Module, Rear Module, Drive Train, Gear Box, Generator, machine foundation, Cabinets, and the other components in nacelle.) (d) Tower (e) Ground Cabinet enclosure & doors (f) Safety features, tower nacelle and Hub (g) Electric cables, fluid and hydraulic hoses (h) Opening & closing of Nacelle hatch. (i) Other parts	No damage that influence safety operation of the wind turbine.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
A2	Oil Level	Check Oil Level and others	Check oil levels and other working fluids and lubricants as follows. If it is necessary, replenish the supply. (a) Gearbox oil level (b) YAW gearbox oil level (c) G.O. Hydraulic unit tank oil level (d) L.O. for Main bearing unit tank oil level	(a) Gearbox oil level: to be center line of left side of gauge (b) YAW gearbox oil level: between shown two lines  (c) G.O. Hydraulic unit tank oil level: between "High Oil Level at Depressurized ACC" & 60mm under this line (d) L.O. for Main bearing unit tank oil level: between "Low Oil Level and operation oil level"	Charge oil if oil level does not satisfy the criteria.	In case of working on the air, wear safety belt. There is a possibility of death or fatal injure.
A3	ACC GAS Press	(7) Check N2 gas press in ACC	Check the accumulator N2 gas pressure and charge gas if the pressure is less than the specific value: - ACC-101: PT-102 - ACC-102: PT-103 - ACC-211,221,231: PT-212, 222, 232	- ACC-101: 13MPa to 14MPa. - ACC-102: 17MPa to 18MPa. - ACC-211,221,231: 10 MPa to 11MPa.	Nitrogen gas pressure of accumulator (ACC-101,102,211,221,231) shall be checked at the ground before Nacelle installation. Charge gas if the pressure does not satisfy the criteria.	Do not inhale the Nitrogen gas. There is a possibility of fatal damage on the brain or cause death

MWT92/2.4

Commissioning Test Procedure (2/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
A4	Cable termination & connection	(1) Check cable bolts condition	Check the following cable bolts condition: (a) Grounding cable bolts (Top Control/ Converter/ Top Powar/ Hub/ Ground) (b) 690V/230V cable bolts (Top Control/Ground) (c) High Voltage cable bolts (Transformer/SWGR)	No looseness connection.		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
		(2) Check cable termination & connector looseness	Check that the cable terminations are not loose and all connections of the cable joints are tightened.	No looseness connection.		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
		(3) Check damage of electrical components	(a) Check damage of the component parts (b) Make sure that all exposed live parts are covered with the protections (c) Parts in the control panel are installed properly especially the sockets and the braces of the relays	No damage		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
		(4) Wiring check	Make sure that the wiring is connected as specified in the reference drawing.	Accordance with the electrical drawing.		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
A5	Instrument Setting	(1) Adjust the instrument settings	Check Q8, Q5, Q2, Q9 in the TOP control cabinet is disconnected. Adjust the following settings of the instruments and the protection. -KS2T: On Delay Timer (Top Control) -KT1, KR330A: Off Delay Timer (Top Control) -K50: One shot output (Top Control) -K108: Off Delay Timer (Hub) -BT*: Thermostat (Top Control/Converter/Top Power/Hub/Ground) -R*: Space Heater (Top Control/Converter/Hub) -HT1: Hygrostat (Converter) -Q**: Thermal Relay (Top Control) -OCR: Over Current Relay (Switch Gear): depending on customer -GFR: Earth Leakage Relay (Transformer) -OSD: Over Speed Detector (Top Control) -Q8/Q5/Q2/Q9: Circuit Breaker (Top Control)	In accordance with Instrument Setting List		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(2) Check Top PLC and Hub PLC.	Confirm Setting of jumper pin & switch in Top PLC and Hub PLC.	In accordance with Instrument Setting List	To be configned by PLC supplier.	In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.

MWT92/2.4

Commissioning Test Procedure (3/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
A6	Dielectric Test of Auxiliary motor and equipment	Measurement of insulation resistance	Measure insulation resistance of the following auxiliaries using 500VDC megger: (a) Generator terminal - ground (b) Step up transformer terminal - ground (c) No.1 YAW Motor terminal - ground (d) No.2 YAW Motor terminal - ground (e) No.3 YAW Motor terminal - ground (f) No.4 YAW Motor terminal - ground (g) G.O. Pump Motor terminal - ground (h) G.O. Cooler Motor terminal - ground (i) Main Bearing L.O. Pump Motor terminal - ground (j) Main Bearing L.O. Cooler/Gear Box L.O Cooler A Motor terminal - ground (k) Gear Box L.O Pump A Motor terminal - ground (l) Gear Box L.O Pump B Motor terminal - ground (m) Gear Box L.O Cooler B Motor terminal - ground (n) Transformer Cooler Fan Motor terminal - ground (o) Converter Cooling Water Cooler Fan Motor terminal - ground (p) Converter Cooling Pump Motor terminal - ground (q) Generator Inner Cooling Fan A Motor terminal - ground (r) Generator Inner Cooling Fan B Motor terminal - ground (s) Generator Outer Cooling Fan Motor terminal - ground (t) Gear Box L.O. Heater A, B, C, D, E - ground (u) Main Bearing L.O. Heater - ground	5M-ohm or more		Do not touch the cables with electricity. There is a possibility of fatal damage or death.

No.	Test Item	Confirmation point	Procedure	Criteria	Remarks	For Safety
Step B. After Temporary Electric Power Receiving:						
CAUTION: *Do not touch any parts in Top Power cabinet, Top Converter cabinet, especially 690 voltage line and high voltage line and so on when electrical system is energized.* ***CAUTION:*** *During receiving power from grid to the turbine, all people in and on the turbine shall be noticed.* *The temporary power could be connected to the external terminal on the Ground Cabinet.*						
B1	Phase, voltage & frequency check	(1) Measurement of incoming voltage	(a) Check all breaker in the control cabinet is disconnected. (b) In Top Converter Cabinet, connect Q2 breaker. (c) And measure the voltage between the phases at the following terminals of downstream side of F62. Confirm the incoming voltage is 690Vac±10%. - R-S:F62, between terminals 2 & 4 - S-T:F62, between terminals 4 & 6 - T-R:F62, between terminals 6 & 2 (d) Measure the voltage between the terminals 2, 3, 4 (R, S, T) of downstream side of F62 and ground. And confirm the voltage is 398V±10 %. - between terminals 2 of F62 and earth bar - between terminals 3 of F62 and earth bar - between terminals 4 of F62 and earth bar (e) At the same time, read the CCU detected voltage value using Operation Terminal (OT) and record.	(c) - R-S: 690±69Vac - S-T: 690±69Vac - T-R: 690±69Vac (d) - R- earth bar: 398±39.8Vac - S- earth bar: 398±39.8Vac - T- earth bar: 398±39.8Vac		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
		(2) Measurement of incoming frequency.	(a) Measure the frequency at the terminals 2, 3, 4 (R, S, T) of downstream side of F62.and check the incoming frequency is within 60±5Hz. (b) At the same time, read the CCU detected voltage value using Operation Terminal (OT) and record.	60 ± 5Hz		Do not touch the cables with electricity. There is a possibility of fatal damage or death.
		(4) Measurement of power supply voltage	Measure following power supply voltage: (a) UPS output (Ground) (b) G1/G2/G3 (Top Control) (c) G1/G2/G4 (Hub) (d) G1 (Ground) (e) UPS Cabinet	(a) 230Vac±23V (b) 24.0Vdc +0.5/-0V (c) 24.0Vdc +0.5/-0V (d) 24.0Vdc +0.5/-0V (e) 120Vdc ± 12V		Do not touch the cables with electricity. There is a possibility of fatal damage or death.

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
B2	Visual inspection of installation	(1) Inspect corrosion, weld spot and paint damage	Inspect nacelle for corrosion, Weld spot and paint damage. Confirm Hub bolts and Tower Bolts are painted.	No corrosion, weld spot and paint damage. If it is, record the points and repair it.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(2) Recording serial number of main components	Check serial number of main components	(Fill in the coversheet of commissioning check sheet)		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
B3	Control Cabinet	(1) Confirmation of PLC and CCU start-up	(a) Confirmation of CCU start-up (b) Confirmation of TOP PLC start-up (c) Confirmation of HUB PLC start-up or TOP/HUB communication condition	- CCU LED indicates "88". - Top PLC's LED indicates "8". - HUB PLC's LED indicates "8" Or TOP/ HUB Communication is correct(No alarm and U51 operating.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(2) Check and adjust setting of PLC	(a) Communication setting (IP address) as per customer's instruction (b) Calendar setting (Date, Time) (c) Columnar wind (if necessary) as per customer's instruction (d) Memory clear	(a)As per Customer's instruction (b) Local current date and time (c) As per Customer's instruction (d) Memory is cleared.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
B4	Ground Cabinet	(1) Communication check of operation terminal	Confirm updating of the display screen data of Operation Terminal in Ground Cabinet.	Check display data		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(2) Communication check of Maintenance Tool	Connect maintenance tool to Ground Cabinet, and confirm online monitoring function of PLC.	Check display data		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
B5	Check leakage	(1) Check leakage visually at all plugs, hoses, fittings and rotating shaft seals.	(a) Gearbox (b) Gear coupling (c) Main bearing (d) Oil piping joints (pressure gauge panel, tank, etc.) (e) Rotor hub hydraulics and rotary joint (f) L.O Coolers and inlet / Outlet piping, Pipe protection or insulation to be fitted, if necessary. (g) Fine Filter and Piping, suction valve to be opened. (h) Water Coolers	No leakage		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.

MWT92/2.4

Commissioning Test Procedure (6/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
B6	Governing Oil Line	(1) Check rotating direction of G.O Pump Motor (OP-101)	Confirm G.O. pump rotates in the specified direction. (in an instant) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive G.O. pump motor.	Same direction as arrow put on motor No abnormal noise.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(2) Check rotating direction of G.O Cooling Pump (C-101)	Confirm G.O. cooler rotates in the specified direction. (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive G.O cooler motor according to the request from mechanical advisor.	Same direction as arrow put on motor No abnormal noise.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(3) Check Oil pressure of G.O. Pump	Confirm the oil pressure (PT-101)rises to the specified level:	more than 27.5±0.5MPa.		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(4) Check Oil Leakage	Check leakage at all plugs, hoses, fittings and rotating shaft seals.	No oil leakage		In case of working on the air, wear safety belt. Never touch the rotating object. There is a possibility of death or fatal injure.
		(5) Rod length of Boosters Adjustment	(a) Service Brake Booster If rod length is out of the required range, adjust the booster length. (b) Yaw Brake Booster If rod length is out of the required range, adjust the booster length.	[Service Brake] At Brake on: 200±5mm [Yaw Brake] At Brake on: 150±5mm		Do not touch the moving object. There is a possibility of fatal injure.
		(6) Service Brake Check	(a) Activate check Activate the service brake at the service brake switch-A or B and release it after making sure the blade feathering position. (b) Release check Repeat (a) some times with checking rotor fixed and gap between brake pads and brake disk.	(a) Stop rotor (b) Gap; from 2.5 -0.85mm to 2.5 +1.10mm	Before service brake control, G.O. system shall be checked and G.O. system will be operated correctly.	Make sure blade is in feathering position. Do not touch the rotating object. That may cause fatal injury.
B7	Gear Box Lubricant Oil line	(1) Check rotating direction of L.O Pump Motor (OP-303, 305)	Confirm L.O. pumps rotate in the specified direction. (OP-303,305) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive Gearbox L.O. pump motor.	Same direction as arrow put on motor No abnormal noise.		Do not touch the rotating object. There is a possibility of fatal injure.
		(2) Check rotating direction of L.O Cooler (C-301, 302)	Confirm L.O. coolers rotate in the specified direction. (C-301, 302) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive L.O. Cooler.	Same direction as arrow put on motor No abnormal noise.		Do not touch the rotating object. There is a possibility of fatal injure.
		(3) Check Oil pressure of L.O. Pump	Confirm the oil pressure (PT-301) rises to the specified level:	0.1~0.5MPa		Do not touch the rotating object. There is a possibility of fatal injure.
		(4) Check oil leakage	Check leakage at all plugs, hoses, fittings and rotating shaft seals.	No leakage		Watch your standing place. Oil may change the floor slippy. Slippy floor could cause fatal injure.
		(5) Check G.B. L.O. Heater operation	Momentary operate G.B. L.O. HEATER (H-301) from Operation Terminal, and confirm no thermal trip.			
B8	Main Bearing Lubricant Oil Line	(1) Check rotating direction of L.O pump motor. (OP-306)	Confirm L.O. pumps rotate in the specified direction. (OP-306) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive Main Bearing L.O. pump motor.	clockwise as view from motor non drive end No abnormal noise from the pump.		Do not touch the rotating object. There is a possibility of fatal injure.

Commissioning Test Procedure (7/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
		(2) Check L.O pressure	Confirm pressure switch (PS-302) output is "ON".	"ON".	The output of PS-302 will be ON when the pressure exceeds 0.06MPa.	Watch your standing place. Oil may change the floor slippy. Slippy floor could cause fatal injure.
		(3) Check oil leakage	Check leakage at all plugs, hoses, fittings and rotating shaft seals.	No oil leakage		Watch your standing place. Oil may change the floor slippy. Slippy floor could cause fatal injure.
		(4) Check M.B. L.O. Heater operation	Momentary operate M.B. L.O. HEATER (H-303) from Operation Terminal, and confirm no thermal trip.			
B9	Converter Cooling Water line	(1) Check rotating direction of Converter Cooling Pump Motor(OP-401)	Confirm Converter Cooling Pump motor rotate in the specified direction. (OP-401) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive Converter Cooling Pump motor.	same direction as arrow put on motor		Do not touch the rotating object. There is a possibility of fatal injure.
		(2) Check rotating direction of Converter Water Cooler Fan (C-401)	Confirm Converter Water Cooler Fan rotate in the specified direction. (C-401) (a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive Converter Cooling fan motor.	same direction as arrow put on motor		Do not touch the rotating object. There is a possibility of fatal injure.
		(3) Check water leakage	Check leakage at all plugs, hoses, fittings and rotating shaft seals.	No leakage		Watch your standing place. Oil may change the floor slippy. Slippy floor could cause fatal injure.
		(4) Check water flow and volume	(a) Turn on the circuit breaker and contactor manually by handy operating terminal to drive Converter Cooling pump motor. (b) Confirm Water volume (FT-401) at Operation Terminal rises to the specified level.	100~120L/min		
		(5) Check Water Pressure	Confirm water pressure (PT-401) rises to the specified level.	0.23-0.4MPa.		

Commissioning Test Procedure (8/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
B10	Generator	(1) Fill in the start up report	Fill in the start up report			
		(2) Check electro fan's rotational direction of generator.	Momentary operate each Generator Fan (M-5, M-6, M-7) from Operation Terminal, and confirm it rotate in the specified direction.	same direction as arrow put on motor		Do not touch the rotating object. There is a possibility of fatal injure.
		(3) Check heater's resistance of generator.	Measure the following heater resistance (a) DE heating resistance (b) NDE heating resistance (c) Slip ring heating resistance			Do not touch the wire on electricity.
		(4) Check electro fan's consumption of generator	Operate the electro fan and measure the current and voltage in case of low speed and high speed. (a) Generator Inner Air Left Fan (M-5) (b) Generator Inner Air Right Fan (M-6) (c) Generator External Air Circuit Fan (M-7)			
		(5) Generator accessories	(a) Check non rotational elements cleared. (b) Check automatic lubricant system is suitable to be used and the dial is set. (c) Check number (quantity), states and contacting surface of brushes of slip-ring and drive end earth brush of generator.	(a) Cleared (b) Dial is set at "12" (c) Number, states surface		Do not touch the rotating object. There is a possibility of fatal injure.
B11	Step-up Transformer	Transformer Cooling FAN rotating direction	Momentary operate TRANSFORMER COOLING FAN (C-305) from Operation Terminal, and confirm it rotate in the specified direction.	same direction as arrow put on motor		Do not touch the rotating object. There is a possibility of fatal injure.
B12	Sensors	(1) Check wind speed by ultra sonic wind sensors.	Compare the difference between average wind speed of MX-108 and MX-109 (for one second).	5m/s or less		
		(2) Check wind direction by ultra sonic wind sensors.	Compare the difference between average wind direction of MX-108 and MX-109 (for 10 min).	15degree or less		

Commissioning Test Procedure (9/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
B13	Yaw Control System	(1) Check before Yawing	(a) Check cable twisting of power and communication cable between nacelle and tower. (b) Confirm grease to Yaw gear tooth. (c) Confirm Yaw brake oil leakage after manually ON/OFF operating of Yaw brake.	(a) No twisting (b) Enough or not (c) No leakage		Do not touch the rotating object. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Adjust the yaw direction.	Rotate nacelle manually to the Main Wind Direction of site arrangement drawing. Confirm the nacelle direction in Operation Terminal indicates 0 degree (±12.1deg). If different, re-adjust zero position by rotating cam after removing the gear locking screw of Yaw potentiometer.	0 degree ±12.1deg		Do not touch the rotating object. There is apossibility of fatal injure.
		(3) Check the yawing.	(a) Turn on the circuit breaker and contactor manually and rotate yaw to make sure that the nacelle rotates to the right and left as viewed from top of the nacelle. Operate the yaw driving system by Operation Terminal. - To Right turn 30deg, push "Turn Right" button on Operation Terminal. - To Left turn 30deg, push "Turn Left" button on Operation Terminal. Check that there is no abnormal noise, twisting cable and interference during yawing between left and right turn.	Correct direction, no abnormal noise, twisting cable and interference during yawing		Do not touch the rotating object. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(4) Functioning of Software Yaw Limit	(a) Temporarily set the "Software Yaw Limit" setting to "+5deg" of the current actual Yaw angle. (b) Manually rotate Yaw motor, and confirm further Yaw rotation by Yaw motor is inhibited when Yaw angle exceed the above temporary setting value. NOTE: When detecting Software Yaw Limit , this Test can be finished.		Witness Test Item	Do not touch the rotating object. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
B14	Blade Pitch Control System	(1) Pitch motion check	(a) Operate pitch blade to fine and feather direction, and check the blade pitch motion (fine and feather direction)	(a) Pitch motion : Visual Check & OT (-109 to -14 deg and return to -109 deg.)	10 minute wind speed shall be less than maintenance speed and nacelle direction shall be 90 degree offset against wind direction.	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Pitch memory	(a) Memorize the data of the pitch angle at the direction of –109 deg. (b) Memorize the data of the pitch angle at the direction of –14 deg.	(a) –109±1deg (b) –14±1deg		
		(3) Check the pitch operation.	Check the pitch operation during safety shut down excluding the effect of dumper zone. (a) Rotate nacelle direction to 90 degree from wind direction.(b) Move pitch angle to operating fine angle using Operation Terminal. Press emergency push button and Measure the time operation from fine to feather	less than 20sec.		Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(4) Check the pitch operation in emergency condition	Check the pitch operation at emergency shut down mode. (a) Measure the time at maintenance PC during operation to fine position. (-109 to -14 deg.)	7 to 8 deg/sec during first 2 seconds. 5 to 6 deg/sec after first 2 seconds.		Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
815	FSI Unit Calibration	Scanning the sensors for FSI unit (for MWT95)	10 minute wind speed shall be less than maintenance speed and nacelle direction shall be 90 degree offset against wind direction. Rotor shall be locked by inserting lock-pins. (a) Scanning the sensors (b) Check the number of the sensors and measurement value (c) Store the configuration to the memory (d) Confirm the communication of the load measurement value by checking on touch panel.	Scaning is completed correctly.		
816	Safety System Test	(1) Emergency Switch	Turn the blade pitch to the direction of -14deg. by manual operation prior to this check. (a) Push the emergency PB switch in Ground Cabinet, TOP cabinet, Gear Box, or Yaw Module. (b) Pitch brake is activated according to Safety Shutdown pitch rate. (c) After emergency switch trigger, Service brake is activated in 60 seconds or generator speed decreased down to service brake ready speed. (d) Measure the time during operation.	(d) less than 40 sec	Witness Test Item	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Hardware Yaw Limit	(a) Forcibly set the Yaw Limit switch input. (b) Safety relay activate and WTG automatically shutdown.	Safety Relay (KS2) activate	Witness Test Item	
		(3) Nacelle shock sensor	(a) Forcibly activate Nacelle shock sensor input, by manually flip the shock sensor. (b) Confirm activation of safety relay.	Safety Relay (KS2) activate	Witness Test Item	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(4) Functioning of Control System	(1) Disconnect fiber optic cable between TOP cabinet and HUB cabinet. (2) Confirm activation of safety relay.	Safety Relay (KS2) activate	Witness Test Item	
817	Surge absorbers	Check Surge Absorbers.	Check that LED of the surge absorbers is green.	LED (green) on		
818	Interference of rotating parts	Check the interference of rotating parts	(a) Make sure that the locking pins (low speed, high speed) and service brake is released. (b) Make sure that there is not interference part of rotating shaft around. - Brakes - Speed sensors	No contact	-Blade pitch must be returned to the feathering position -Under the strong wind, manually yaw the nacelle to 90 degree against the wind flow.	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
819	Lighting	Check the tower light.	Confirm whether all lights are turned on normally.	All lights turn on		Do not touch the electrified wire. There is a possibility of fatal injure and electrification.

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
Step C. After Grid Electric Power Receiving:						
C1	Phase, voltage & frequency check	(1) Measurement of incoming voltage	(a) Check all breaker in the control cabinet is disconnected. (b) In Top Converter Cabinet, connect Q2 breaker. (c) And measure the voltage between the phases at the following terminals of downstream side of F62. Confirm the incoming voltage is 690Vac±10%. - R-S: F62, between terminals 2 & 4 - S-T: F62, between terminals 4 & 6 - T-R: F62, between terminals 6 & 2 (d) Measure the voltage between the terminals 2, 3, 4 (R, S, T) of downstream side of F62 and ground. And confirm the voltage is 398V±10 %. - between terminals 2 of F62 and earth bar - between terminals 3 of F62 and earth bar - between terminals 4 of F62 and earth bar (e) At the same time, read the CCU detected voltage value using Operation Terminal (OT) and record.	(c) - R-S: 690±69Vac - S-T: 690±69Vac - T-R: 690±69Vac (d) - R- earth bar: 398±39.8Vac - S- earth bar: 398±39.8Vac - T- earth bar: 398±39.8Vac		Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Measurement of incoming frequency.	(a) Measure the frequency at the terminals 2, 3, 4 (R, S, T) of downstream side of F62.and check the incoming frequency is within 60±1Hz. (b) At the same time, read the CCU detected voltage value using Operation Terminal (OT) and record.	60±1Hz	If the frequency is in following range, this test can be carried out by the customer's acceptance. Range; 61 to 63Hz or 59 to 57Hz	Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
C2	Safety System Test	(1) Activation Speed (HSS)	(a) Temporarily setup Overspeed Detector setting from 1346.3rpm (117% of rated speed) to 600rpm. (b) Startup turbine When rotational speed reaches to the activation speed, the pitch brake is activated and shutdown turbine.	HSS speed when activating Safety shutdown - At 600rpm (at HSS) [7.8rpm at LSS] Turbine Trip The following alarm shall be displayed on the Handy Operational Terminal. -SS2401 HSS Over Speed	Witness Test Item Note; Setting value must be restored after testing.	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Activation Speed (LSS)	(a) Temporarily setup Overspeed Detector setting from17.55rpm (117% of rated speed) to 6.8rpm. (b) Startup turbine When rotational speed reaches to the activation speed, the pitch brake is activated and shutdown turbine.	LSS speed when activating Safety shutdown - At 6.5rpm (at LSS) [506.3rpm at HSS] Turbine Trip The following alarm shall be displayed on the Handy Operational Terminal. -SS2401 HSS Over Speed	Witness Test Item Note; Setting value must be restored after testing.	Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(3) Q8 Breaker	(a) Forcibly activate the "SS1 from PLC" signal. (b) Confirm disconnection of generator from the grid, and at the same time of pitch braking.	Confirm Fault Message of Operation Terminal - SS2517: SS1 from PLC SS2000: Stator Circuit Breaker Trip	Witness Test Item	Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
C3	FSI Unit Calibration	Calibration of FSI unit for AIPC system (for MWT95)	(a) Rotate the rotor by turning motor and stop the rotor when blade position is at vertical position. (b) Auto-calibrate the load value by measuring the azimuth angle and load date measured by FSI unit	Calibrated correctly		

MWT92/2.4

Commissioning Test Procedure (12/13)

No.	Test Item	Confirmation points			Procedure	Criteria	Remarks	For Safety
C4	Check before synchronization	(1) Safety synchronization	check before	(a) Confirm circuit breakers are in "ON" position. (b) Make sure Service Brake Switches and Emergency Push Buttons are "OFF" position. (c) Make sure the following parts of the wind turbine does not make abnormal noise, vibration and oil leakage while the rotor is up to running speed, and during operation. -Blades and hub -Shaft and bearings -Gearbox -Generator -Hydraulic unit -Yaw drive gear box and motors -Control panels	No abnormal noise and vibration	Caution Move out from the nacelle to the ground before the generator synchronization.	Evacuate from the Wind Turbine before synchronization. There is a possibility of fatal injure and electrification.
		(2) Check synchronization.	auto start-up	prior to	- Monitor the generator rotating speed and blade pitch angle. Make sure that the blade pitch angle moves from +109 to the set degree for starting up automatically. The rotating speed of the rotor will be increasing.	Auto start-up.	The set degree is changed on site condition and pitch adjustment by MHI	Do not touch the rotating object. Do not enter into rotating object while rotating. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.

MWT92/2.4

Commissioning Test Procedure (13/13)

No.	Test Item	Confirmation points	Procedure	Criteria	Remarks	For Safety
Step D. After synchronization						
01	Check required to conclude the commissioning	(1) Oil leakage after trial test	After the turbine has run for the period of 2~3 minutes, recheck for any oil leakage of the hydraulic system pipe joints, gearbox lubrication pipe joints & tank filters and generator. Also make sure there are no noises or vibration at the nacelle, the generator and so on during the above turbine operation.			Do not touch the rotating object. Do not enter the rotating object while moving. Do not touch the electrified wire. There is a possibility of fatal injure and electrification.
		(2) Confirmation data	Check the following data on handy operating terminal. (a) Wind Speed (b) Generator Output (c) Wind Dir. Difference (d) Alternating Voltage (e) Network Voltage (f) Frequency (g) Power Factor (h) Generator Winding Temperature (i) Generator Bearing (DE) Temperature (j) Generator Bearing (NDE) Temperature (k) Generator Slip-ring cover Temperature (l) Governing Oil Temperature (m) Main bearing Lubricant Oil Temperature (n) Main bearing Temperature (o) Gearbox Lubricant Oil Temperature (p) Gearbox High Speed Bearing Temperature (q) Converter cooling water Temperature (r) Inside Converter/Power cabinet Temperature (s) Ambient Temperature (t) Inside Nacelle Temperature (u) Integrated Total Output of Generator (v) Integrated Total Internal Power Consumption (w) Integrated Total Running Hours - Press "STOP" button on handy operating terminal. Make sure that the generator is disconnected and wind turbine stops. (Blades are in the feather position.)			
		(3) Confirmation of Check Sheet	When all systems have checked out as acceptable, commissioning phase concludes.			

6. COMMISSIONING CHECK SHEET

A copy of the commissioning check sheet in the following pages shall be sent to :

- Operator/Maintenance Manual
- Manufacturer
- Developer
- Independent Engineer

COMMISSIONING CHECK SHEET FOR MWT92(95)/2.4

• MANUFACTURER	: MITSUBISHI HEAVY INDUSTRIES, LTD. NAGASAKI SHIPYARD & MACHINERY WORKS 180 Koyagi-cho, Nagasaki, Japan
• OPERATOR	: NAME
• DATE	: Energization: Commissioning Completion:
• LOCATION OF WTG	:
• NACELLE SERIAL NO.	: Front Module: , Rear Module: Yaw Module:
• HUB SERIAL NO.	:
• BLADES SERIAL NO.	: No.1: No.2: No.3:
• GEAR BOX SER. NO.	:
• GENERATOR SER. NO.	:
• TOWER SERIAL NO.	: Upper: Middle: Lower:
• CABINET SER. NO.	: Tower: Nacelle:
• WIND SENSOR SER. NO.	: MX-108: MX-109:

COPY
Operator/ Maintenance manual
Manufacturer
Building Authority
Expert Witness

CHECK SHEET FOR MECHANICAL PERSONNEL

No.	CHECK LIST	REQUIREMENT	RESULT	REMARKS
A.	**Before the electric power receiving**			
A1	**Visual inspection of installation**			
(1)	Check the tightening of structural bolts			
	(a) Blade connecting bolts	Tight	OK • NO good	
	(b) Hub connecting bolts	Tight	OK • NO good	
	(c) Tower-Yaw module connecting bolts	Tight	OK • NO good	
	(d) Tower middle flange bolts	Tight	OK • NO good	
	(e) Tower internal ladder installation	Tight	OK • NO good	
	(f) Bolts for Ground Cabinet	Tight	OK • NO good	
(2)	Visual inspection of damage			
	(a) Blades	No damage	OK • NO good	
	(b) HUB	No damage	OK • NO good	
	(c) Nacelle(Front Module, Rear Module)	No damage	OK • NO good	
	(d) Tower	No damage	OK • NO good	
	(e) Ground Cabinet, enclosure, doors	No damage	OK • NO good	
	(f) Safety features, Tower nacelle and Hub	No damage	OK • NO good	
	(g) Electrical cables and hydraulic hoses	No damage	OK • NO good	
	(h) Opening & closing of Nacelle hatch.	No damage	OK • NO good	
	(i) Other part (_____)	No damage	OK • NO good	
A2	**Oil level**			
	(a) Gearbox oil level	To be center of side gauge	OK • NO good	Not Added / Added
	(b) Yaw gear box oil level	To be between two lines referred to commissioning test procedure	OK • NO good	Not Added / Added
	(c) G.O. hydraulic unit tank oil level	To be between "High Oil Level at Depressurized ACC" & 60mm under this line	OK • NO good	Not Added / Added
	(d) L.O. for Main bearing unit tank oil level	To be between "Max Oil Level and operational oil level	OK • NO good	Not Added / Added
A3	**ACC N2 GAS Pressure**			
	Check the gas pressure in accumulator [ACC-101]	13~14MPa	OK • NO good (_____MPa)	Not Charged / Charged
	[ACC-102]	17~18MPa	OK • NO good (_____MPa)	Not Charged / Charged
	[ACC-211]	10~11MPa	OK • NO good (_____MPa)	Not Charged / Charged
	[ACC-221]	10~11MPa	OK • NO good (_____MPa)	Not Charged / Charged
	[ACC-231]	10~11MPa	OK • NO good (_____MPa)	Not Charged / Charged
A4	**Cable termination & connection**			
(1)	Check cable bolt condition.			
	(a) Grounding cable bolts	Tight	OK • NO good	
	(b) 690V/230V cable bolts	Tight	OK • NO good	
	(c) High Voltage cable bolts	Tight	OK • NO good	
(2)	Check cable termination & connector looseness	Tight	OK • NO good	
(3)	Check damage of electrical components	No damage	OK • NO good	
(4)	Wiring check	Accordance with the electrical drawing.	OK • NO good	
A5	**Instrument Setting**			
(1)	Adjust the instrument settings	In accordance with Instrument Setting List	OK • NO good	
(2)	Check Top PLC and Hub PLC.		OK • NO good	

No.	CHECK LIST	REQUIREMENT	RESULT	REMARKS
A6	**Insulation test of Auxiliary motor and equipment**			
	Measurement of insulation resistance.	500V Megger		
	(a) Generator terminal - ground	5Mohm or more	OK • NO good	
	(b) Step up transformer terminal - ground	5Mohm or more	OK • NO good	
	(c) No.1 YAW Motor - ground	5Mohm or more	OK • NO good	
	(d) No.2 YAW Motor - ground	5Mohm or more	OK • NO good	
	(e) No.3 YAW Motor - ground	5Mohm or more	OK • NO good	
	(f) No.4 YAW Motor - ground	5Mohm or more	OK • NO good	
	(g) G.O. Pump Motor - ground	5Mohm or more	OK • NO good	
	(h) G.O. Cooler Motor - ground	5Mohm or more	OK • NO good	
	(i) Main Bearing L.O. Pump Motor - ground	5Mohm or more	OK • NO good	
	(j) Main Bearing L.O. Cooler/Gear Box L.O Cooler A Motor - ground	5Mohm or more	OK • NO good	
	(k) Gear Box L.O Pump A Motor - ground	5Mohm or more	OK • NO good	
	(l) Gear Box L.O Pump B Motor - ground	5Mohm or more	OK • NO good	
	(m) Gear Box L.O Cooler B Motor - ground	5Mohm or more	OK • NO good	
	(n) Transformer Cooler Fan Motor - ground	5Mohm or more	OK • NO good	
	(o) Converter Cooling Water Cooler Fan Motor - ground	5Mohm or more	OK • NO good	
	(p) Converter Cooling Pump Motor - ground	5Mohm or more	OK • NO good	
	(q) Generator Inner Cooling Fan A Motor - ground	5Mohm or more	OK • NO good	
	(r) Generator Inner Cooling Fan B Motor - ground	5Mohm or more	OK • NO good	
	(s) Generator Outer Cooling Fan Motor - ground	5Mohm or more	OK • NO good	
	(t) Gear Box L.O. Heater A, B, C, D, E - ground	5Mohm or more	OK • NO good	
	(u) Main Bearing L.O. Heater – ground	5Mohm or more	OK • NO good	

No.	CHECK LIST	REQUIREMENT	RESULT	REMARKS
B	**After temporary electric power receiving**			
B1	**Phase, voltage & frequency check**			
(1)	Measurement of incoming voltage.		OK • NO good	
	- R-S:	690±69Vac	(V)	
	- S-T:	690±69Vac	(V)	
	- T-R:	690±69Vac	(V)	
	- R- earth bar:	398±39.8Vac	(V)	
	- S- earth bar:	398±39.8Vac	(V)	
	- T- earth bar:	398±39.8Vac	(V)	
(2)	Measurement of incoming frequency	60±5Hz	OK • NO good (Hz)	
(3	Measurement of power supply voltage		OK • NO good	
	(a) UPS output (Ground)	230±23Vac	(V)	
	(b) G1/G2/G3 (Top Control)	24.0+0/0.5Vdc	(V)	
	(c) G1/G2/G4 (Hub)	24.0+0/0.5Vdc	(V)	
	(d) G1 (Ground)	24.0+0/0.5Vdc	(V)	
	(e) UPS cabinet	120Vdc±12V	(V)	
B2	**Visual Inspection of Installation**			
(1)	Inspect corrosion, weld spot and paint damage	Visual	OK • NO good	Dwg.No
	Parts and point (Hub bolts)	No damage		( )
		Visual	OK • NO good	Dwg.No
	Parts and point (Tower bolts)	No damage		( )
		Visual	OK • NO good	Dwg.No
	Other point ( )	No damage		( )
B3	**Control Cabinet**			
(1)	Confirmation of PLC and CCU start-up			
	(a) CCU's LED	"88"	OK • NO good	
	(b) Top PLC's LED	"8"	OK • NO good	
	(c) Hub PLC's LED	"8"	OK • NO good	
(2)	Check and adjust setting of PLC Input data.			
	(a) Communication (IP address)	As per customer' instruction	OK • NO good	
	(b) Calendar (Date, Time)	Local current date and time	OK • NO good	
	(c) Columnar wind	As per customer' instruction	OK • NO good	
	(d) Memory clear	Memory is cleared	OK • NO good	